Theoretical Value for Gravitational Constant

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Addendum I & Chasing Alpha
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Abstract

This paper develops the theoretical ratio of the gravitational force to electromagnetic force between two electrons. The resulting ratio produces a gravitational constant with the precision of electromagnetic constants.

The developed ratio based on the 2018 Codata alpha is 2.4007107861E-43(7). The ratio calculated directly from 2018 Codata values is 2.40061E-43(5).

The March, 2016 ratio based on the 2014 Codata alpha was 2.4007107842E-43(11). The ratio calculated directly from 2014 Codata values is 2.40053E-43(11).

This calculation developed from an understanding of the metaphysical underpinnings of our universe. The validation of this understanding provides the greatest value of the calculation. Implications about the gauge factor also emerge.

Addendum I exposes an error in the paper and a direction for correcting it.

Overview

The ratio of the gravitational force to electromagnetic force between two electrons will be referred to as *ggee*. The calculation of *ggee* assumes the charge of the electron creates the mass of the electron. This assumption leads to a simple and novel expression for *ggee*.

The *ggee* ratio calculation evolves from a metaphysical structure of space and related interactions as described at http://spaceandmatter.org.

The chronology of the different parts of the calculation of the *ggee* ratio supports that the ratio resulted from a calculation without bias toward achieving a particular value. Of particular note is the need to modify the theoretical *ggee* directly obtained by $alpha^2$ in order to reproduce the experimental value. This provides a clue as to the metaphysical origin of the gauge factor.

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Realms

When thinking about laws governing the interactions of Nature it can be helpful to consider different realms in which different laws may govern those interactions. The metaphysical foundation underlying the theoretical *ggee* ratio suggests the Realms listed here.

These realms provide context for the *ggee* ratio calculation. The implications of that context provides meaningful insight into the realms themselves.

Some Realms listed contain significant speculation. Other Realms follow directly from the metaphysical foundation. All Realms described relate to the foundation that produces the theoretical *ggee* ratio.

- **Multiverse Realm —** The workings of the Space Fabric Realm seem far removed from the Multiverse Realm. However, the Space Fabric Realm helps us to understand what could constitute a universe, how multiple universes could coexist and how they might connect. The Multiverse Realm remains conjecture, but the realm acquires a sense of being possible or even likely.

  The Multiverse Realm seems plausible due to the seemingly vast emptiness embedded in the Space Fabric Realm. Albeit, extension has no real meaning in the Space Fabric Realm so we can't know that a concept of vast emptiness even applies. The fabric of space must be closely synchronized. This indicates the likelihood of multiple fabrics of space with different synchronizations.

- **Universe Realm —** The Universe Realm calls for us to consider the beginning, the growth and the extent of the universe.

  The ability to create and maintain the fabric of space points to a growth process instead of an expansion process due to the likely discreteness of the fabric of space. Inserting more space into a discrete fabric means adding a discrete unit. Stretching units would have no meaning since the units themselves provide the measure.

- **Cosmological Realm —** The Cosmological Realm governs the form and interactions of massive objects; or, over great distances.

  Dark Energy and Dark Matter fall into this realm. General Relativity forms much of the basis for current understandings of the Cosmological Realm.

  The validity of the theoretical *ggee* ratio calculation provides an understanding of time in the Cosmological Realm. This understanding leads to major consequences in how the Cosmological Realm can be viewed.

- **Physical Realm —** The Physical Realm forms what we recognize as the behavior of the world around us. It is the quantification of the behavior of this realm that forms the basis for the traditional role of physics.

- **Quantum Realm —** The Quantum Realm deals with behaviors on a scale where normal physical laws cannot be directly applied. This realm provides a way of computationally relating wave-like behaviors; or, quantized behaviors.

  The Quantum Realm may be considered an extension of the Physical Realm to a more intricate interaction level that incorporates wave relationships and quantized physical characteristics.

- **Particle Realm —** The Particle Realm organizes constituent parts of matter with numerous conserved relationships.

  The Particle Realm may be considered an extension of the Physical Realm to a smaller, more intricate, organized structural level.

- **Space Fabric Realm —** The Space Fabric Realm provides the underlying structure that imparts context to all realms.

  Calculation of the theoretical *ggee* ratio relies on a precise understanding of this underlying structure. In turn, the success of the *ggee* ratio calculation confirms the assumed underlying structure.

- **Metaphysical Realm —** The Metaphysical Realm consists of the concepts and metaphysical laws responsible for creating and maintaining the fabric of space. This realm provides an understanding of the origin of gravity.

  The word *metaphysics* carries several very different meanings. In this paper *metaphysics* refers to specific concepts and metaphysical laws absent any magic, vagueness or spiritual meaning.

  The Metaphysical Realm emanates from *something* and *nothing*. *Something* exhibits no characteristics; otherwise, it would not be the most simple beginning. *Nothing* means the absence of all, even the fabric of space.

  It may seem impossible to build the fabric of space from *something* and *nothing*. The key lies in *nothing*. *Nothing* mathematically allows any assumed coordinate system to be equally valid.

  This paper makes no attempt to cover the metaphysical origin of the fabric of space. Rather, it focuses on the detailed calculation of the *ggee* ratio.

Donuts

In order to follow the *ggee* ratio calculation one needs some understanding of the underlying donut structure. This description provides donut characteristics that apply to the calculation. The more complete metaphysical logic underlying donuts and donut chains falls outside the scope of this paper. The *ggee* ratio calculation results validate the donut view.

The *ggee* calculation develops from an assumed structure and interactions governing the fabric of space. The fabric of space under this view derives from *something* and *nothing*. *Something* lacks all physical characteristics. *Something* nondestructively interacts with other *somethings* by simply canceling opposing motion when contact occurs. *Nothing* means the complete absence of anything, even the fabric of space. Concepts of *extension*, *time*, and *motion* lack meaning at this metaphysical level.

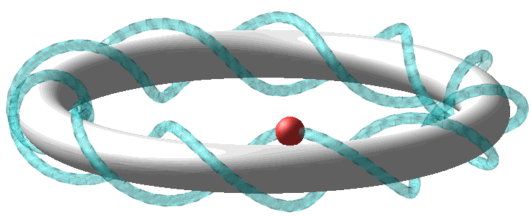

Figure 1: Basic donut chain link.

figure 1. shows a donut. The donut shown has 11 nodes that complete in two revolutions (because of intertwining). The red ball represents *something*. The remainder of the image serves only to help visualize the path. An animated version of this image may be seen at: http://spaceandmatter.org/dn.htm.

Normally, objects travel in a straight line in the absence of an external force. The donut motion occurs in *nothing* (a complete void) which allows it to be viewed as traveling in the manner demonstrated.

The illustrated donut provides a way for us to physically visualize the metaphysical donut. The metaphysical level is *event* and *phase* driven. *When* and *where* provide metaphorically useful descriptions for explaining donut behavior.

The donut gains context only by reference to an assumed coordinate system. Multiple donuts periodically contacting each other provide the needed context. For donuts to be a stable part of the fabric of space they must be part of a chain segment. The chain segment must be connected to the fabric of space on both ends to maintain stability.

Chain Segments

Chain segments figuratively provide the strands used to create the fabric of space and matter. On one level the chain segments provide a mathematical tool used to perform calculations in the metaphysical realm. On another level, the chain segments provide an excellent visualization of relationships and behavior in the metaphysical realm. It is useful to think of the chain segments as real.

A chain segment forms from connected donut links. As it is used in this paper, a chain segment connects to other chain segments on both ends. To be connected means that a chain segment branches on both ends. We always consider one chain segment as being connected to two other chain segments on each end. This means that each end donut link has a total of three chain segments connected to it. The concept of *extension* does not exist at this metaphysical level.

For chain segment length we count only one of the two connecting end donut links. Chain segments with even numbered link counts have their connecting end donut links parallel for untwisted chain segments (either in phase; or, π radians out of phase). Chain segments with odd numbered link counts have their connecting end donut links perpendicular for untwisted chain segments ($\pi/2$ radians out of phase).

We will later find that the space fabric that we think of as a vacuum develops from chain segments 138 links in length. The electron has one link missing which requires a twist in order to connect. The electron forms from a 137 link chain segment.

Readers may think the electron length of 137 comes from nearness to the fine structure constant. It does not. The 137 link chain segment length comes directly from a calculation. The 137 length forms because it is two orders of magnitude more stable than the next closest candidate. These lengths emerged from a calculation in 1996. The underlying assumptions provided an excellent basis for continued work.

The dependence of calculations on much earlier and unchanging results forms an important part of this paper. The *ggee* ratio calculation produces theoretical results so precise that it is helpful to understand how such a result could be found.

Event Probabilities

Events forge and closely synchronize the Metaphysical Realm. A synchronized view of contact events provides the means to do calculations in this realm. The donut (i.e. chain link) helps to visualize event synchronization.

Contact between the *somethings* of adjacent donut links constitute a ***contact event***. A contact event can only occur if a ***contact node*** simultaneously occurs in adjacent donuts. This requires the correct *where* and *when* for both donut links.

Visualize a toy Slinky bent completely around on itself to resemble a donut. Think of the Slinky's spiral spring as a path traveled by *something*. Define a ***donut path*** to be this spiral path.

Consider the donut as a link in a chain segment. Chain links make contact with adjacent chain links on the inside of each link. A donut works the same. Define a ***contact line*** as the part of a donut closest to the donut hole. The contact line forms the circumference of a circle that surrounds the donut hole and just touches the donut.

A *contact node* occurs at each point where the *donut path* intersects the *contact line*. The contact nodes for a donut constitute the eligible places the next event can occur. The label *"contact node"* refers to a location and instant on the donut path. At that location and instant, contact with another *something* could possibly occur.

Inverting the number of contact nodes yields the frequency with which an event occurs. Complex environments can appear to exhibit a stochastic view of the frequency. Confined environments, such as a particular chain segment, exhibit a more deterministic view of the frequency.

A *contact event* between adjacent donuts occurs when their respective *somethings* arrive simultaneously at contact nodes located in the same place, albeit in separate donuts.

Many conditions must be met in order for a *contact event* to occur. This may make the events seem unlikely. Remember that nothing happens until a contact event occurs however unlikely the event may seem.

Node Calculations

Node calculations rely on angles. For these calculations we ignore *extension*. Extension lacks meaning at this level, albeit useful for visualizing relationships. To help describe the node calculation, the donut from the *Event Probabilities* section provides a visualization.

For a node to exist the donut path traveled must eventually repeat its pattern. Consider the toroidal phase (major circular position around the center of the donut hole) and poloidal phase (minor circular position around the donut surface) of *something* at a moment in the donut path. A third phase exists in the form of the orientation of the donut axis, but that does not factor directly into the node calculations.

For visualization purposes, we choose to view our donut radii such that the *donut path* angle on the inside of the donut (i.e. *contact line*) will exactly produce the desired node count for the donut.

Define this connecting angle between donuts as the ***contact phase angle***, $\boldsymbol{\phi}$. The orientation of untwisted chain segment links differs by $\pi/2$ between adjacent links. This produces an angle of $\phi = \pi/4$ connecting two untwisted links. The angle ϕ plays a pivotal role in contact nodes and in solving for the *ggee* ratio.

We describe radii to help visualize the donuts. The *ggee* calculation *excludes* these radii. Extension lacks meaning in the metaphysical realm.

The major (toroidal) radius equals $\boldsymbol{R}$ measured from the center of the donut hole to the inside of the torus (the *contact line*). The major angular velocity equals $\boldsymbol{\Omega}$.

The minor (poloidal) radius equals $\boldsymbol{r}$ measured from the center of the torus to the surface of the torus. The minor angular velocity (poloidal) equals $\boldsymbol{\omega}$.

For an untwisted chain segment, the following visualization relationship holds:

$$\omega\, r = \Omega\, R$$

Define $\boldsymbol{p}$ as the number of *primary contact nodes* in one revolution of a donut link. For a simple untwisted chain segment this produces:

$$\omega = p\,\Omega \quad \text{and;} \quad p\, r = R$$

When a single link is removed from an untwisted chain segment, the remaining chain segment must be twisted in order to maintain contact. This produces a *contact phase angle* different than $\pi/4$.

Define the *target* contact phase angle as $\boldsymbol{\phi_{target}}$; and the *solution* contact phase angle as $\boldsymbol{\phi_{solution}}$. Define the difference as the *collision* angle, $\boldsymbol{\phi_{collision}}$. This section details the process used to calculate $\phi_{solution}$ for a desired primary contact node count, p; and a given target angle, ϕ_{target}.

Consider the twisted chain segment where a link is removed and twist is added. We will later find this describes the electron. Define the length of the untwisted chain segment prior to removal of a link as equal to $\boldsymbol{n}$.

The target contact phase angle for the twisted chain segment equals:

$$\phi_{target} \; = \; \frac{\pi}{4} \; + \; \frac{\pi}{2(n-1)} \tag{1}$$

This spreads the twist from the missing link over the remaining $n-1$ links. The factor 2 accounts for the midline of the contact angle.

It helps to consider ω and Ω to be revolution counts then only whole numbers can synchronize. The irrational value of $\tan(\phi_{target})$ usually necessitates rounding.

Let $\boldsymbol{m}$ define the number of major revolutions needed to synchronize p primary contact modes. Thus, m provides finer gradations in the primary contact nodes.

For toroidal 'motion' the incremental unit value of Ω is:

$$\Delta\,\Omega = \frac{1}{m\,p} \tag{2}$$

For poloidal 'motion' the incremental value of $\Delta\,\omega_{target}$ in terms of Ω units generally is non-integer due to the need to achieve the correct contact phase angle, ϕ_{target}:

$$\Delta\,\omega_{target} = \frac{\tan(\phi_{target})}{m\,p} \tag{3}$$

Node stability determines m. In the Electron Motion Section below we find p to be a function of n:

$$p = (n-1)\,(n+1) \tag{4}$$

Values for Ω and $\omega_{solution}$ can be determined directly if we already know m and p. Originally, an iterative process using equation (3). A direct solution follows.

Ω equals the inverse of equation (2):

$$\Omega = mp \tag{5}$$

$\omega_{solution}$ equals the rounded inverse of equation (3):

$$\omega_{solution} = \text{round}\left[\frac{mp}{\tan(\phi_{target})}\right] \tag{6}$$

Solve for $\phi_{solution}$ using equations (5) and (6):

$$\phi_{solution} = \tan^{-1}\left[\frac{\omega_{solution}}{\Omega}\right] \tag{7}$$

The use of tangent intentionally differs between equations (3) and (7). Equation (3) relates poloidal nodes to toroidal nodes. Equation (7) relates the twist geometry.

Solve for $\phi_{collision}$ using equations (7) and (1):

$$\phi_{collision} = \left|\phi_{solution} - \phi_{target}\right| \tag{8}$$

The solution m for the electron ends up being over two orders of magnitude more stable than the next best choice. Even trying a wide range of choices for stability measures produces the same result. The accuracy of the final *ggee* calculation indicates a high level of certainty that the correct solution was found.

Node Stability Measures

We determine m by testing *node stability measures*. These measures are chosen on the basis of judgement. As such, the measures should not be considered inviolable. Fortunately, the same correct solution emerges from a wide range of choices for the measures. The stability measure factors used are:

- untwisted chain segment length — n^{-1}
- poloidal revolution count — $\omega_{solution}^{-2}$
- major toroidal revolution count — $m_{solution}^{-1}$
- collision angle — $\phi_{collision}^{-2}$

Accordant Synchronization

Contact between adjacent donuts requires both toroidal and poloidal phase synchronization. However, the need for synchronized events extends beyond adjacent donuts. Individual donuts must also synchronize with other donuts both within their chain segment and beyond to adjacent chain segments.

Think of toroidal and poloidal synchronization as positional synchronizations on perpendicular axes. Elapsed time needs *master clock* synchronization to accord with events that occur beyond the donuts directly involved. Elapsed time can be represented by the hypotenuse of a right triangle formed with one leg equal to $\omega_{solution}$ and the other leg equal to Ω.

The legs of the right triangle use integer values to attain synchronization. For *accordant synchronization* we need the hypotenuse to be a rational number. Due to its irrational nature, the hypotenuse must use a suitably rounded value.

Choosing a suitably rounded value for an irrational number can be problematic. Unless a clear choice exists the ambiguity of the result can lead to manipulation.

A large number of rational estimates (fractions) exists for an irrational number. How do we know when we have found the correct estimate? It helps to understand how the hypotenuse fraction and the triangle leg factors enter into a solution.

In solving for a fractional value to best represent the hypotenuse we need an idea of the precision required. This involves judgement. I suggest summing the number of digits in both legs and doubling the sum. This should get you in the ballpark. With the benefit of hindsight I recommend a minimum of 22 significant digits and prefer 26. Casio has a good online calculator if needed.

This paper makes no attempt to discuss techniques for developing a rational estimate for an irrational number. The reader can look at the result obtained for the electron and try to find a better one. This should provide a feel for the integrity of the estimate. *Accordant synchronization* of the hypotenuse for the electron dramatically decreases the frequency of *contact events*.

Multiplying the units in each triangle leg will produce positional synchronization. Now, we must include factors for the hypotenuse timing. To account for *accordant synchronization* of the hypotenuse we multiply by *both* the numerator and the denominator of the fraction for the hypotenuse. We *exclude* factors already present in the legs. Synchronization for the excluded factors has already been accomplished. The excluded factors further improve the stability of the electron.

Electron Motion

Before performing the node calculations, we first need to examine the electron motion process. This process reveals p, the desired primary contact node count.

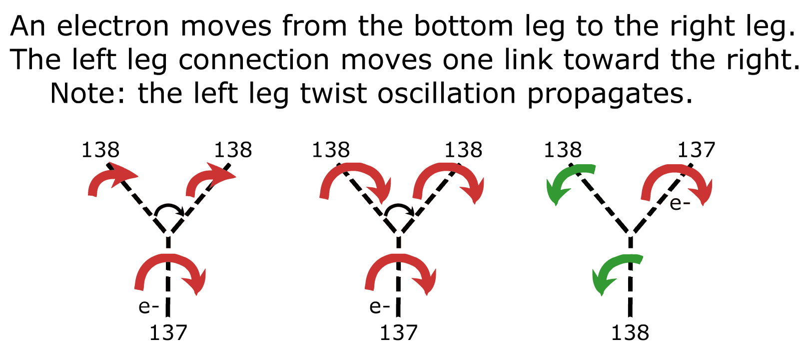

Figure 2: Electron moving through space.

figure 2. illustrates the segment chain length and segment twisting that occurs when an electron moves from one chain segment to the next. The electron moves from the bottom to the right chain segment. This motion occurs due to the left chain segment changing its attachment point by one donut link (small black arrow).

The illustration shows the chain segment twisting that occurs. This twisting concept may factor into quantum mechanical standing wave relationships. For this paper the twisting can be ignored.

Consider what happens if multiple electrons travel the same path. The chain segments traveled by the electron will need to move in the opposite direction. If this fails to happen, an electric field will develop. Think of the motion of the space strand as the magnetic vector potential.

The strand of space that moves in the opposite direction from the electron must have its connecting chain segments (i.e. those not directly in the moving strand path) change their attachment point.

In normal space when a connection changes its attachment point there will momentarily be a strand with one extra link and a strand with one fewer links. In the case of space chain segments with 138 links, there would momentarily be chain segments of 137 and 139 links when only one space connection has moved. Chain segment lengths of $(n-1)$ and $(n+1)$ must participate in synchronization. The desired primary node count, p, equals $(n-1)(n+1)$ to facilitate synchronization.

Electron Structure

The electron structure described in this paper emerges from a metaphysical understanding of how the fabric of space formed from *something* and *nothing*. The logic of the metaphysical underpinnings is not included with this paper.

Normally, objects travel in a straight line in the absence of an external force. The donut motion occurs in *nothing* (a complete void) which allows it to be viewed as traveling in the manner demonstrated.

The fabric of space consists of donut chain segments containing 138 donut links. The electron consists of a donut chain segment 137 links long. The electron chain segment is twisted because it has one fewer donut links than the fabric of space.

Donuts that form the electron chain segment have 74445 nodes that complete in four toroidal revolutions. It takes 76172 toroidal node units to synchronize with the external chain segments of space. Thus, it takes $74445 * 76172$ revolutions to be in the original position. In order to make contact donuts must synchronize time-wise as well as position-wise. This requires *accordant synchronization*.

This solution best aligns the angle between donuts that results from having 137 links in the electron chain segment.

The 138 and 137 chain segment lengths for space and the electron, respectively, resulted from solving a relationship. The stability of this solution exceeds the stability of the next best solution by over 2 orders of magnitude. This is the reason dimensionless numbers close to 137 have special significance in physics.

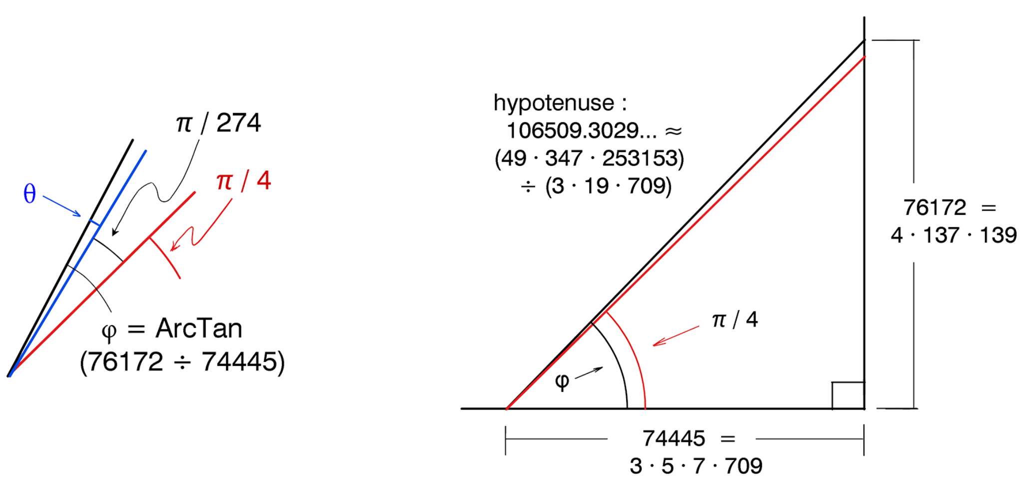

Figure 3: Components for the ggee ratio calculation.

Formula for ggee Ratio

The *ggee* ratio calculation originates from the assumption that matter slows time combined with the assumption that the mass of the electron is due entirely to its charge. A concept of drag, d, helps facilitate this analysis. Drag is the slowing of time caused by mass. Drag is considered as being in close proximity to the mass.

The rate of flow of time in close proximity to a mass is slowed by the drag. This allows us to represent the mass as creating a new flow rate of time slowed by the drag, d. For the electron this takes the form:

$$t_e = 1 - d_e \tag{9}$$

If we were to double the mass we double the drag, d. For two electrons this takes the form:

$$t_{e+e} = 1 - 2\,d_e \tag{10}$$

For two electrons the flow rate of time is simply multiplied to get the effect of each electron on the other.

$$t_{ee} = (1 - d_e)^2 \tag{11}$$

Expanding:

$$t_{ee} = 1 - 2\,d_e + {d_e}^2 \tag{12}$$

Consider Equation (12). The mass associated with two electrons attributed to charge is 2 d_e. The mass loss associated with the force of gravity is d_{e^2}. This yields the following ratio for *ggee*:

$$ggee = \frac{{d_e}^2}{2\,d_e} \tag{13}$$

Or:

$$ggee = \frac{d_e}{2} \tag{14}$$

What does Equation (14) mean? We consider the electron structure in answering this question. Later, we will discover that the electromagnetic coupling constant (alpha) squared balances the experimental value with the theoretical value.

Calculation of ggee Ratio

The theoretical drag, d_e, in Equation (14) separates into component factors:

$$d_e = \begin{bmatrix} \text{motion lost} \\ \text{for each} \\ \text{contact event} \end{bmatrix} \begin{bmatrix} \text{number of} \\ \text{internal} \\ \text{contact events} \end{bmatrix} \begin{bmatrix} \text{frequency of} \\ \text{internal} \\ \text{contact events} \end{bmatrix} \begin{bmatrix} \text{frequency of} \\ \text{external} \\ \text{contact events} \end{bmatrix} \quad (15)$$

Motion lost for each contact event, using equation (7):

$$1 - \cos(\phi_{collision}) \approx \frac{\phi^2_{collision}}{2} = \frac{\left[\tan^{-1}(\frac{76172}{74445}) - \frac{\pi}{4} - \frac{\pi}{274}\right]^2}{2}$$

$$= \frac{[8.08727858986336E - 11]^2}{2}$$

Number of internal contact events (two for each connection):

$$2n = 2 \cdot 137$$

Frequency of internal contact events with both the numerator and denominator of the hypotenuse as factors:

$$freq_{int} = \left[\frac{1}{3 \cdot 5 \cdot 7 \cdot 709}\right] \left[\frac{1}{4 \cdot 137 \cdot 139}\right] \left[\frac{1}{7 \cdot \cancel{7} \cdot 347 \cdot 253153}\right] \left[\frac{1}{\cancel{3} \cdot 19 \cdot \cancel{709}}\right]$$

Frequency of external contact events from both ends with 3 nodes in the connecting link and square of the electron coupling constant (one for each electron):

$$freq_{ext} = \frac{2}{3}\alpha^2$$

Ratio of gravitational force to electromagnetic force between two electrons substituting equation (15) into equation (14):

$$ggee = \frac{1}{2}\left[\frac{[8.08727858986336\times 10^{-11}]^2}{2}\right][274]\left[\frac{1}{74445}\cdot\frac{1}{76172}\cdot\frac{1}{7\cdot 347\cdot 253153\cdot 19}\right]\left[\frac{2}{3}\alpha^2\right]$$

or,

$$ggee = \left[4.50826219213487\times 10^{-39}\right]\alpha^2 \tag{16}$$

This is an exact relationship with precision dependent only on the computational precision and the precision of the electron coupling constant.

Gravitational Constant

The constants below are used to calculate G_{theory} using the relationship $G_{theory} = ggee \cdot \mathrm{c}^2 \cdot r_\mathrm{e} \,/\, m_\mathrm{e}$. The constant α is used in Equation (16) for $ggee$.

	fundamental physical constants used in G_{theory} calculation[2][3][4]			
	$\boldsymbol{\alpha}$	$\boldsymbol{c}$	$\boldsymbol{r_e}$	$\boldsymbol{m_e}$
×	10^{-3}	10^{8}	10^{-15}	10^{-31}
1969	7.297 351(11)	2.997 925 00(100)	2.817 939(13)	9.109 558(54)
1973	7.297 3506(60)	2.997 924 58(1.2)	2.817 9380(70)	9.109 534(47)
1986	7.297 353 08(33)	2.997 924 58	2.817 940 92(38)	9.109 3897(54)
1998	7.297 352 533(27)	2.997 924 58	2.817 940 285(31)	9.109 381 88(72)
2002	7.297 352 568(24)	2.997 924 58	2.817 940 325(28)	9.109 3826(16)
2006	7.297 352 5376(50)	2.997 924 58	2.817 940 2894(58)	9.109 382 15(45)
2010	7.297 352 5698(24)	2.997 924 58	2.817 940 3267(27)	9.109 382 91(40)
2014	7.297 352 5664(17)	2.997 924 58	2.817 940 3227(19)	9.109 383 56(11)
2018	7.297 352 5693(11)	2.997 924 58	2.817 940 3262(13)	9.109 383 7015(28)

Table 1: Chronology of Selected Fundamental Physical Constants

	from theory		from CODATA	*ratio*
	ggee **ratio**	G_{theory}	G_{codata}	$\frac{G_{theory}}{G_{codata}}$
$\times$	10^{-43}	10^{-11}	10^{-11}	1
1969	2.400 7097(72)	6.674 449(40)	6.6732(31)	1.00019(46)
1973	2.400 7094(39)	6.674 462(34)	6.6720(41)	1.00037(61)
1986	2.400 711 02(22)	6.674 5792(40)	6.672 59(85)	1.00030(13)
1998	2.400 710 659(18)	6.674 582 47(53)	6.673(10)	1.00024(150)
2002	2.400 710 682(16)	6.674 5821(12)	6.6742(10)	1.000057(150)
2006	2.400 710 6618(33)	6.674 582 29(33)	6.674 28(67)	1.000045(100)
2010	2.400 710 6830(16)	6.674 581 88(29)	6.673 84(80)	1.000111(120)
2014	2.400 710 6807(11)	6.674 581 389(81)	6.674 08(31)	1.000075(46)
2018	2.400 710 682 66(72)	6.674 581 2990(21)	6.674 30(15)	1.000042(22)

Table 2: Theory Results Versus CODATA Values for Gravitational Constant

Table 1. values and Table 2. G_{codata} values come directly from legacy fundamental value tables. The *ggee* ratio values result from substituting α into equation (16).

The constant included in equation (16) is exact and does not vary. The identical constant would have emerged in 1969 had the theory been completed at that time. It is important to realize that equation (16) comes directly from theory.

The results in Table 2. may lead one to believe the theory's greatest value lies in the greatly improved precision for the gravitational constant. It does not. The precision of equation (16) and Table 2. validate the underlying metaphysical assumptions about the nature of the universe. This understanding provides the greatest value.

Table 2. does not provide backward validation of equation (16). Rather, Table 2. provides a perspective for the precision of historical values for r_e, m_e and G_{codata}.

The *ratio* column of Table 2. indicates a bias (all ratios exceed 1). Any bias likely comes from the particular usage of α or from a bias in the G_{codata} value.

Discussion

This paper does *not* unify gravity and electromagnetism. Much remains for others to do in the Quantum Realm to achieve unification. Quantum effects are indicated in the event relationships between donuts. However, these effects fall outside the scope of this paper. Determining whether the effects lead to definitive answers in quantum field theory would best be determined by someone skilled in that area.

The relationships described come from an understanding of the metaphysics underlying the fabric of space. To describe the details would detract from the presentation of the calculations shown. Instead, the metaphysical aspects have been presented as events without any reasoning as to why they must occur.

Originally, I pursued understanding the metaphysical realm from curiosity. It did not seem likely that numbers and detailed relationships would emerge. The *ggee* ratio calculation validates that metaphysical basis. The ratio calculation was never attempted until after the factors from the electron structure triangle had been found. In other words, this was not a forced relationship. It flowed from the underlying calculations.

The realms in the first section are all impacted by the underlying metaphysics. They are presented here to describe their relationship to the metaphysical realm.

For anyone interested in the metaphysical realm underlying this I suggest visiting: http://spaceandmatter.org/thursdaythoughts/thursdaythoughts.htm. Please note that the thoughts labeled "clues" are in need of revision.

Addendum I

Addendum I December 20, 2020 addresses a mistake in the original paper.

The Electron Structure section treats nodes as though they remain unchanged after a contact event. This seems quite unlikely. However, ignoring changes due to contact events still produces a result that fits well with observations, except for the apparent bias mentioned in the Gravitational Constant section on page 15.

The fine Structure Constant, α, may provide a clue about contact events. The clues emerge from prime factors that produce an estimate of α. The value resulting from the factors falls well outside of the standard range of error for α. However, the factors can be restated to seemingly relate to the behavior at hand.

The following prime factors produce an estimate for α:

$$\alpha = \frac{1}{137} \cdot \frac{3^4 \cdot 47}{2^5 \cdot 7 \cdot 17} \tag{17}$$

Evaluating to eleven significant digits:

$$\alpha = 7.297\ 353\ 2478 \text{ E-03}$$

CoData 2018 value for alpha with a standard uncertainty of 11 in the last two digits:

$$\alpha = 7.297\ 352\ 5693 \text{ E-03}$$

The difference between the evaluated value and the CoData 2018 value is 6785 in the last four digits; or, about 600 times the standard uncertainty. This renders the evaluated expression as having no real value in this form.

Multiply the numerator and denominator of Equation (17) by 5 and restructure:

$$\alpha = \frac{1}{137} \cdot \frac{(138^2 - 3^2)}{(138^2 - 2^2)} \tag{18}$$

Completely independently and preceding this result the model of the fabric of space determined a chain length of the space fabric to be 138 links and of the electron to be 137 links. Equation (18) thus provides a relationship worthy of considering.

Equation (18) might be irrelevant. The mechanism underlying this relationship is unknown, and the value lies far outside of a standard error range.

Chasing Alpha

The inclusion of α in Equation (16) as the Electron Coupling Constant combined with the form of Equation (18) provide food for thought. Ideally, the resolution of that thought would reproduce α exactly. Such a task goes far beyond this paper. However, there are interesting features of Equations (16) and (18); and of the space and electron chain segments that might provide some direction.

It is noteworthy that contact node factors of the electron chain segment all appear in the denominator of Equation (16). Similarly, we would expect the factors in Equation (18) to appear in the denominator. How, then do we account for the numerator? Consider the possibility that the denominator associates with the electron chain segment (137 links) and the numerator associates with the space chain segment (138 links).

The space chain segment contains an even number of links and is untwisted. This allows exact alignment between alternating links of 135 nodes and 141 nodes (+3 and -3). A 135 node link could occur adjacent to the electron chain segment on both ends. This would produce a symmetrical field from the electron.

The electron chain segment contains an odd number of links and is twisted. This combination does not lend itself to alternating links in an obvious manner. It does seem likely that the electron chain links have an additional node factor of 138 to facilitate communication with the space chain links. The factor $(138^2 - 2^2)$ resembles the form commonly seen for outbound and return paths. A relationship between this form and the node changes that occur due to contact events does not present itself, but remains an intriguing possibility.

For both the space chain segment and the electron space segment, a propagation process occurs along each chain segment. It is not known whether the effects from those processes would bring α into an acceptable range. It is also not known if these effects would reduce biases that seem to exist in Table 2.

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