FEYNMAN'S ADVANCED WAVES UNIFY THE SCALAR HIGGS BOSON WITH THE SUPPOSEDLY UNRELATED NON-SCALAR GRAVITON

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Abstract -

Recently added: "Main two clarifications to my submission" -

There are two points which may need to be clarified -

First, in relation to E=0 (second last paragraph in SECTION 2 – QUANTUM SPIN, ADVANCED WAVES, AND SPECIAL RELATIVITY)

Second, in relation to quantum spin/vector/tensor/scalar (last and third last paragraphs in SECTION 2 – QUANTUM SPIN, ADVANCED WAVES, AND SPECIAL RELATIVITY)

This article suggests existence of the graviton was actually confirmed by discovery of the supposedly unrelated Higgs boson on 4 July 2012. First suspected to exist in the 1960s, more studies are still needed to verify with higher precision that the discovered particle has all of the properties predicted. The need for further studies is in line with this article's proposal that the Higgs boson and field are not what they're assumed to be ie the Higgs field is believed to give mass to some particles (quarks and charged leptons plus the weak nuclear force's W and Z bosons) while the Higgs boson is said to be the field's quantum excitation. The proposal here is that photon-graviton interactions, and thus the electromagnetic-gravitational fields - more precisely, $m = (D_{subscript\ 1+0})$, $(S_{sub\ M}, K_{sub\ 8})$, $(n \times 10_{exponent}{}^{12}.\gamma_{sub\ s}/G_{sub\ s})$ - are responsible for ALL mass, and the Higgs boson (whether it exists in one or several forms) is a "leftover" from the advanced waves formed from photons and gravitons (see the Wheeler-Feynman absorber theory and the Transactional Interpretation of Quantum Mechanics). Being left-over from gravitational waves, the Higgs boson is obviously related to the graviton – and if this article is correct, discovery of the former particle makes existence of the latter absolutely essential (confirms its existence). As well: in my thoughts, Wolfgang Pauli's 1924 approach to quantum spin - and Albert Einstein's 1919 paper "Do gravitational fields play an essential role in the structure of elementary particles?" - both played important parts in uniting quantum mechanics and gravity into the phenomenon of

matter. On the way to this union, Einstein's dream of uniting electromagnetism with gravitation seems to have supersymmetrically fallen into place.

Article -

SECTION 1 -
BASE-2, TOPOLOGICAL MATHEMATICS, AND WICK ROTATION

In relation to Quantum Spin, Wolfgang Pauli in 1924 was the first to propose a doubling of electron states due to a two-valued non-classical "hidden rotation". (Pais, Abraham [1991]. *Niels Bohr's Times*. Oxford: Clarendon Press. p. 201. ISBN 0-19-852049-2) Let's equate the two-valued system with virtual particles^ that can take the two values of binary digits (strings of 1 and 0), and thus have the properties of hidden variables. ^^

^ A virtual particle is a transient fluctuation that exhibits some of the characteristics of an ordinary particle but cannot be detected in experiments. However, they're known to exist because they have the measurable effect of giving rise to forces between particles of matter. This article equates them with the electronic binary digits that are transient and only exist as either a 1 or 0 for an extremely brief time eg as a computer image changes.

^^ Strings of binary digits are proposed to be the Hidden Variables which "are an interpretation of quantum mechanics based on the belief that the theory is incomplete and that there is an underlying layer of reality that contains additional information about the quantum world. This extra information is in the form of the hidden variables, unseen but real quantities. The identification of these hidden variables would lead to exact predictions for the outcomes of measurements and not just probabilities of obtaining certain results." ("Quantum" by Manjit Kumar - Icon Books, 2008 - p. 379)
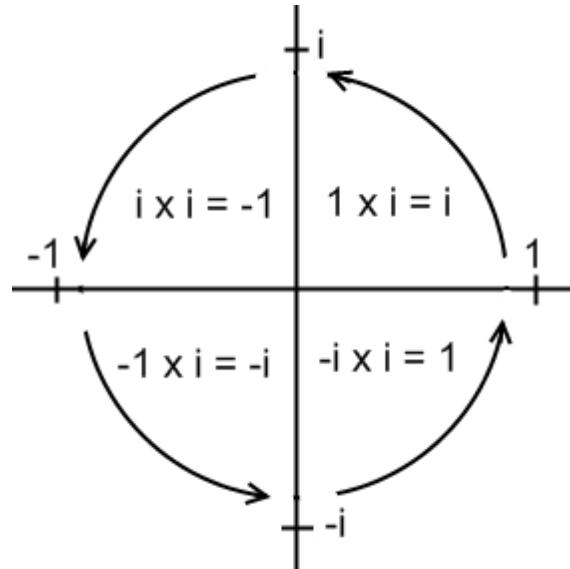
**Figure 1 – WICK ROTATION** (copyright-free content from WordPress.com)

Binary digits can form the 2-dimensional shape in mathematics called a Mobius strip and, following Pauli's doubling, two strips form the 4-dimensional Klein bottle (Polthier Konrad, "Imaging maths - Inside the Klein bottle" - http://plus.maths.org/content/os/issue26/features/mathart/index) which has length, width, depth and, when Wick rotation^ is programmed into the strips as a subroutine, the 4th dimension of movement in time. The type of Klein bottle formed would appear to be the figure-8 Klein. A diagram of many figure-8 Klein bottles would show that their positive curvature (on the spherical parts) fits together with their negative curvature (on saddle-shaped parts) to cancel and produce, on a cosmic scale, the flat curvature of space-time. (WMAP science team - "Wilkinson Microwave Anisotropy Probe" - https://map.gsfc.nasa.gov/)

^ Mathematics has three types of numbers - real, imaginary and complex. Real numbers are exemplified by 0, the positive numbers used in counting and negative numbers. On a two dimensional "Complex Plane", 'Real Numbers' are on the horizontal plane and 'Imaginary Numbers' such as $i=\sqrt{(-1)}$ are on the vertical plane. 'Complex Numbers' can be easily identified as a combination of 'Real Numbers' and 'Imaginary Numbers'. ("Difference Between Complex Numbers and Real Numbers" - June 18, 2011 - Posted by Olivia - https://www.differencebetween.com/difference-between-complex-numbers-and-vs-real-numbers/) "The complex plane reveals i's special relationship with cycles via the circle of i, also known as Wick rotation. Whenever a point on the complex plane

is multiplied by i, it moves a quarter rotation around the origin or center of the plane." ("The Meaning of Imaginary Time: Creativity's Dialog with Timelessness" - Posted on July 15, 2015 by Kerri Welch - https://textureoftime.wordpress.com/2015/07/15/the-meaning-of-imaginary-time/)

Returning to the subject of quantum spin, assign the Mobius the value of spin 1 and the figure-8 Klein bottle (Mobius doublet) a value of spin 2 (the remainder of this paragraph will show the necessity of this assignment). "From Planck Data to Planck Era: Observational Tests of Holographic Cosmology" by Niayesh Afshordi, Claudio Corianò, Luigi Delle Rose, Elizabeth Gould, and Kostas Skenderis: Phys. Rev. Lett. 118, 041301 (2017) - Published 27 January 2017(https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.118.041301) says - In a holographic universe, all of the information in the universe is contained in 2D packages trillions of times smaller than an atom. ("2D packages trillions of times smaller than an atom" could, here, refer to Mobius strips.) Following this paper's example, trillions of Mobius strips are built-up into the spin-1 photon instead of the atom. And trillions of figure-8 Kleins are built-up into the undiscovered graviton, which is expected to have spin-2. ***Doubling the Mobius strip to make the figure-8 Klein bottle thus unites the photon with the graviton, and electromagnetism with gravitation.***

Figure 2 - MOBIUS STRIP (source: http://www.clker.com/cliparts/3/7/a/9/1220546534781713951lummie_Mobius_Strip.svg.hi.png)
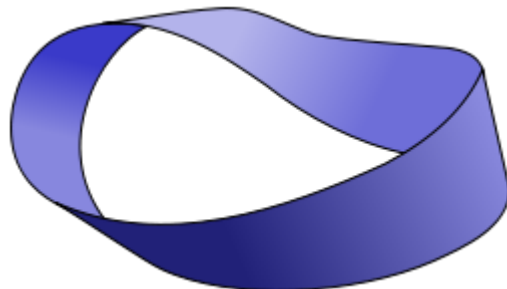
Figure 3 - MOBIUS DOUBLET (FIGURE-8 KLEIN BOTTLE) (source: https://upload.wikimedia.org/wikipedia/commons/7/73/KleinBottle-Figure8-01.png) Note that, when considering many bottles, the reddish positive curvature fits together with the bluish negative curvature to produce the flatness implying space-time's infinity and, since space and time are always unified, its eternity. (In flat space-time, light beams travel in straight lines and can go infinite distance without ever meeting.)
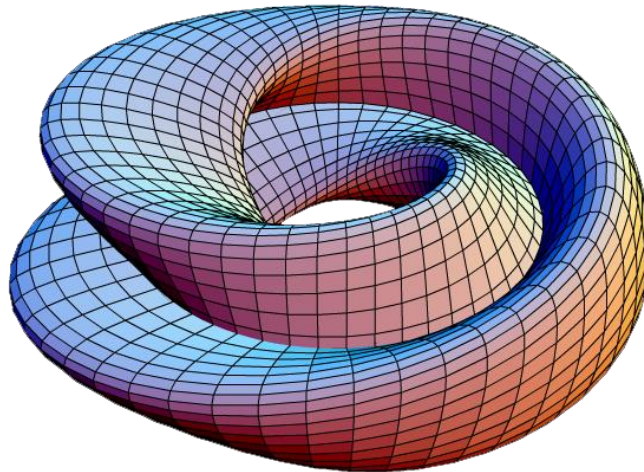
SECTION 2 –

QUANTUM SPIN, ADVANCED WAVES, AND SPECIAL RELATIVITY

Main two clarifications to my submission

There are two points which may need to be clarified -

First, in relation to E=0 (second last paragraph in **SECTION 2 –**

QUANTUM SPIN, ADVANCED WAVES, AND SPECIAL RELATIVITY)

I posted this paragraph some time ago in an article at vixra.org and was dismayed when a reader replied that E does not equal 0. Obviously, it's true that all forms of energy known have a positive value. He simply didn't read the paragraph carefully, for it also says **"the absence of E (energy) refers to there being no interaction of light energy and gravitational energy"**. Still, if one reader can make this mistake, others undoubtedly would too.

In any case, I see the situation of E being positive but also equalling zero as related to the possibility of other large-scale dimensions existing (that paragraph, plus part of the other supplementary file uploaded with my submission [see below], do mention other dimensions).

This part deals with mathematics similar to the matrix, a rectangular array of numbers or symbols placed in rows and columns. Matrices have a long history possibly going back 3,000 years to their use in solving simultaneous equations in China. In the mid-nineteenth century, British mathematician Arthur Cayley discovered how to add, subtract, multiply and divide them.

For example, the underlined entry 2340 in the product is calculated as (2 × 1000) + (3 × 100) + (4 × 10) = 2340:

$$\begin{bmatrix} \underline{2} & \underline{3} & \underline{4} \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 & \underline{1000} \\ 1 & \underline{100} \\ 0 & \underline{10} \end{bmatrix} = \begin{bmatrix} 3 & \underline{2340} \\ 0 & 1000 \end{bmatrix}.$$

Figure - Matrix multiplication

From <https://en.wikipedia.org/wiki/Matrix_(mathematics)> This Wikipedia reference is not used to support a scientific claim, but merely as an example of what basic matrix multiplication looks like.

Matrix mechanics is a version of quantum mechanics discovered by Werner Heisenberg in 1925, and matrix multiplication says X multiplied by Y does not always equal Y times X. The book "Quantum" states, Max Born wrote to Albert Einstein that "Heisenberg's latest paper, soon to be published, appears rather mystifying, but is certainly true and profound." He was referring to "the strange multiplication rule" Heisenberg used in developing matrix mechanics. Born eventually realised that Heisenberg had stumbled on matrix multiplication - to which the originator of matrix mechanics replied, "I do not even know what a matrix is."
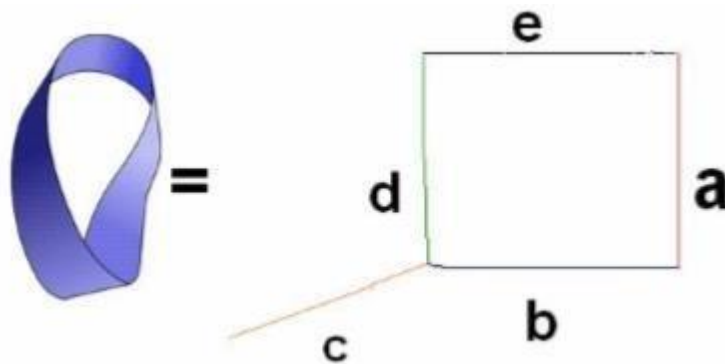
Figure – MOBIUS MATRIX (Mobius equals a,b,c,d,e array)

Width a is perpendicular to the length (b or e) which is perpendicular to height c. How can a line be drawn perpendicular to c without retracing b's path? By positioning it at d, which is then parallel to (or, it could be said, at 180 degrees to) a. d is already at 90 degrees to length b and height c. **d has to be at right angles to length, width and height simultaneously if it's going to include the Complex Plane's vertical imaginary axis in space-time (see next paragraph: the imaginary realm is at a right angle to the 4 known dimensions of space-time, which all reside on the horizontal real plane).** In other words, d has to also be perpendicular to (not parallel to) a. This is accomplished by a twist, like on the right side of the Mobius strip pictured above, existing in a. The twist needs to be more exaggerated than the illustrated one, with the upper right of the Mobius descending parallel to side "a" then turning perpendicular to it at approximately the level of the = sign. Thus, 90+90 (the degrees between b & c added to the

degrees between c & d) can equal 180, making a & d parallel. But 90+90 can also equal 90, making a & d perpendicular. (Saying 90+90=90 sounds ridiculous but it has similarities to the Matrix [of mathematics, not the action-science fiction movie] in which X multiplied by Y does not always equal Y times X. The first 90 plus the second 90 does not always equal the second 90 plus the first 90 because 90+90 can equal either 180 or 90.

The Mobius Matrix can perform the impossible in another dimension of making (a) and (d) perpendicular instead of parallel. In a mathematical universe; mass can be at right angles when, according to present ideas, only parallelism should be possible. It's logical that energy can be zero, or even negative, when – according to present ideas - only positivity should be possible.

Second, in relation to quantum spin/vector/tensor/scalar (last and third last paragraphs in **SECTION 2 – QUANTUM SPIN, ADVANCED WAVES, AND SPECIAL RELATIVITY)**

The following illustration and text will be helpful to many readers in visualizing quantum spin/vector/tensor/scalar (it helped me a lot).
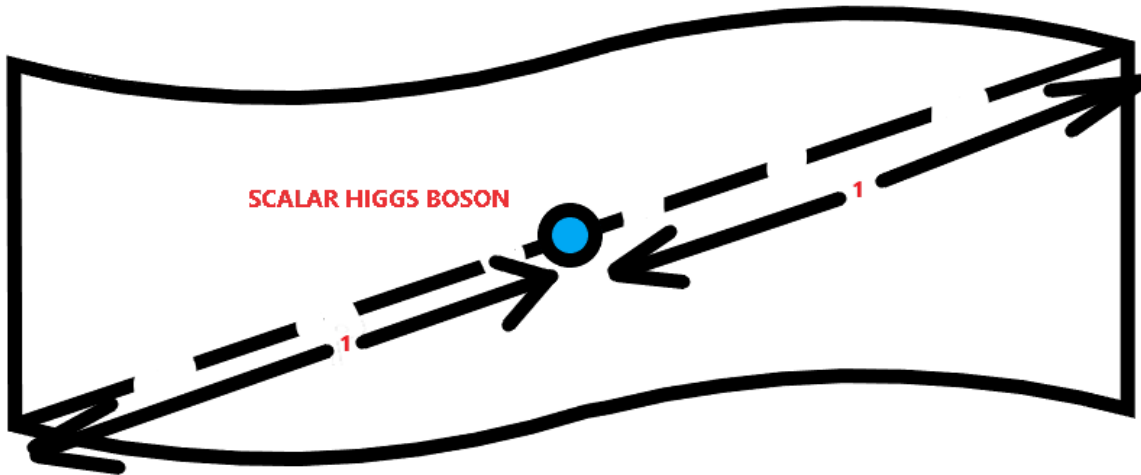
Figure -

VISUALIZING QUANTUM SPIN AND VECTOR/TENSOR/SCALAR QUANTITIES

(drawn by author using Microsoft's "Paint" program)

A **vector** is a quantity which possesses both magnitude and direction. Two such quantities acting on a point (represented by the blue and black Scalar Higgs boson) may be represented by two sides of a parallelogram, so that the resultant diagonal (dashed line) also represents the vector. The two sides and diagonal thus illustrate the graviton's spin 2.

When changing from one set of coordinates to another, a **tensor** is a set of functions which are transformed in a precisely defined manner. When changing from the above figure's diagonal to its point (the Higgs), transformation is in the precise manner of the photon revolving once (through 360 degrees) to look the same – illustrated by either of the red 1's in the diagram. The other 1 represents that particle's continuous interaction with the graviton which simultaneously turns through 180 degrees (half a revolution) TWICE. Subtracting 1 from 1 (half the diagonal from its other half) leaves the spin 0 of the Higgs boson.

Richard Feynman concluded that antimatter is simply ordinary matter going backwards in time (what is termed "matter-antimatter annihilation" occurs when those particles reverse direction in time). The particles and antiparticles involved in annihilation vanish but the mass-energy of gamma-ray photons, neutrinos, and sometimes less-massive particle–antiparticle pairs remains. When photons and gravitons enter the part of their cyclic oscillation where electromagnetic and gravitational waves reverse direction in time, the 125 GeV / c^2 of the known Higgs boson remains. This is a **scalar field** - completely described by its magnitude, without direction, and associated with spin-0 particles. It is representable by a position on a line which, in the diagram above, is the central blue and black dot on the diagonal.

Matter particles (spin 1 / 2) would be formed by photon-graviton interaction (spin 1 divided by spin 2 - see third part of equation 1). The interaction forming the Higgs particle's spin 0 is "destruction" of couplings and their values eg because trillions of Mobius strips are built-up into the spin-1 photon and trillions of figure-8 Kleins are built-up into the spin-2 graviton, 1 trillion gravitons (value = quantity times spin = 2 trillion) and 2 trillion photons (value = 2 trillion times 1). "Destruction" is actually a phenomenon described by Richard Feynman's work on antimatter.^ Feynman concluded that antimatter is simply ordinary matter going backwards in time (what is termed "matter-antimatter annihilation" occurs when that particle reverses direction in time). ("Physics of the Impossible" by Michio Kaku – Penguin Books 2008, pp. 277-278) Visualizing the Complex Plane and Wick rotation, the gravitons forming a gravitational wave^^ cycle or oscillate between its advanced (towards the left and the past) or retarded (towards the right and the future) states. The waves also cycle into the vertical direction: existing in the so-called "imaginary" time which is described by imaginary numbers - and just as familiar time is inextricably joined to familiar space, "imaginary" time may be joined to an "imaginary" space filled with what is referred to as Dark Matter. Photons of the electromagnetic field belong to a vector field in which both magnitude and direction are assigned to each point in space, whereas a scalar field (completely described by its magnitude, without direction, and associated with spin-0 particles) is required since the Higgs boson does exist. The original scalar theory of gravitation is Newtonian gravitation, in which the mass density acts as the source of the field. But this article's answer of "yes" to Einstein's 1919 paper "Do gravitational fields play an essential role in the structure of elementary particles?" means mass density cannot be the source of gravity, and transition to a scalar field through scalar theories of gravitation must be abandoned (which is what Einstein did in late 1914 before moving on to a tensor theory of gravity in 1915's General Relativity) ("Norton, John [1984]. "How Einstein found his field equations:

1912-1915" - http://www.pitt.edu/~jdnorton/papers/Einstein_field_eqn_1-4.pdf). General Relativity agrees that mass density cannot be the source of gravity when it states gravity is an effect of space-time curvature (Albert Einstein, "Feldgleichungen der Gravitation" ["The Field Equations of Gravitation"], *Preussische Akademie der Wissenschaften, Sitzungsberichte*, 1915 [part 2], 844–847). **Photon-graviton interaction leads to a scalar field when the energy released during wave-advancement (see first footnote to this paragraph) is sufficient to produce one or more Higgs bosons.**

^ The word "destruction" is not accurate. Consider the Wheeler-Feynman absorber theory and Transactional Interpretation of Quantum mechanics. (Cramer, John G. [February 1988]. "An Overview of the Transactional Interpretation". International Journal of Theoretical Physics. **27** (2): 227–236. doi:10.1007/BF00670751) These speak of "retarded" electromagnetic waves going forward in time and "advanced" waves going backwards in time. Einstein's gravitational equations contain enough information about electromagnetism to allow electromagnetism equations to be restated in terms of these gravitational fields (George Yuri Rainich, *Transactions of the American Mathematical Society*, 27, 106 - Rainich, G. Y. [1925]), giving gravity retarded and advanced components too. Though the particles and antiparticles involved in annihilation vanish; gamma-ray photons, neutrinos, and sometimes less-massive particle–antiparticle pairs remain. The reaction of 1 kg of antimatter with 1 kg of matter would produce $1.8{\times}10^{17}$ J (roughly 1,000 GeV) of energy (by the mass–energy equivalence formula, $E = mc^2$). (M. G. Sowerby. "Nuclear fission and fusion, and neutron interactions". *Kaye & Laby: Table of Physical & Chemical Constants*. National Physical Laboratory) This is eight times the mass of the Higgs boson, whose production would require a wave-advancement equivalent to the energy produced in an antimatter-matter reaction that leaves, in the case of the only Higgs particle detected to date, a remnant of approximately 125 GeV / c^2.

^^ "… (because it is a *relativistic* field) it (the Higgs field's non-zero value) produces no preferred frame at all. For the density of the air, there is a preferred frame, because one is either at rest with respect to the air or moving through it. But this isn't true for the Higgs field; all observers are at rest with respect to the Higgs field." ("Of Particular Significance - Conversations About Science with Theoretical Physicist Matt Strassler**":** https://profmattstrassler.com/articles-and-posts/particle-physics-basics/how-the-higgs-field-works-with-math/2-why-the-higgs-field-is-non-zero-on-average/) An observer travelling on, or composed of, gravitational and electromagnetic waves is assumed not to be at rest; and therefore not at rest with respect to the Higgs field. Extending the Abstract: photon-graviton interactions, and thus the electromagnetic-gravitational fields, would substitute for the Higgs field itself and not merely the Higgs boson which is stated to be the field's quantum excitation. If gravitons and photons are actually at rest and the term "gravitational and

electromagnetic waves" is no more than a convenient way of speaking, observers would be at rest with respect to the electromagnetic-gravitational field, which has been called the Higgs field. As stated above, interaction of electromagnetic field (vector) and gravitational field (tensor) leads to a scalar field when the energy released during wave-advancement - see first footnote above - is sufficient to produce one or more Higgs bosons. How could this state of rest manifest? Drop a stone into calm water: the particles of water simply rise then fall. It's the wave motion that moves outward. Like water waves, electromagnetic waves are transverse: the particles called photons would have little movement. As Paul Camp, Ph.D. in theoretical physics, writes -

"A photon is a quantum of excitation of the electromagnetic field. That field fills all space and so do its quantum modes." (Paul Camp, Ph.D. in theoretical physics, "How big is a photon?" - https://www.quora.com/How-big-is-a-photon)

It's the disturbances from sources of electromagnetism (excitations of fluctuating amplitudes and frequencies caused by disturbances) that travel at the speed of light, not photons. Gravitation also fills all space, so motion of gravitational waves could be due to fluctuations causing excitations called gravitons. The above ideas of gravitons and photons displaying no relocation are a new interpretation of physicist John Wheeler's geon or "gravitational electromagnetic entity", an electromagnetic or gravitational wave which is held together in a confined region by its own nature. (J. A. Wheeler, [January 1955]. "Geons". Physical Review. 97 (2): 511 - doi:10.1103/PhysRev.97.511)

THE VOLUME COMPOSED OF GRAVITONS AND PHOTONS (SPACE-TIME) ALWAYS REMAINS CONSTANT, MEANING THE UNIVERSE AS A WHOLE CAN'T EXPAND OR CONTRACT. AND IF THERE'S NO EXPANSION, CAN THERE BE ANY NEED FOR THE DARK ENERGY WHICH CAUSES IT?

The water wave-electromagnetic wave equivalence still agrees with Special Relativity's claim that the speed of light is a constant ("Zur Elektrodynamik bewegter Körper" ["On the Electrodynamics of Moving Bodies"] by A. Einstein - *Annalen der Physik [ser. 4]*, **17**, 891–921 [1905]) (c = 0 when referring to the relatively motionless photons*). It also means even the slightest movement by anything exceeds c and results in time travel, which may be why everything in the universe is moving forward at one second per second (reversing the direction of the Wick rotation built into everything by warping space-time should send us backwards in time at one second per second).

*c=0 is consistent with E(energy)=0 in the following manipulation of $E = mc^2$:

E=mc^2 only applies to the photon at rest. Since it's plausible that the photon can indeed be at rest within what is called an electromagnetic wave, the equation seems to tell us that all distances in space, and time, can be completely eliminated (permitting us to instantly

reach anywhere in space-time). Let's represent the masslessness of photons by 0 (zero), and also the masslessness of the theoretical gravitons by zero. Suppose theories developed from Einstein's 1919 paper "Spielen Gravitationfelder im Aufbau der materiellen Elementarteilchen eine wesentliche Rolle?" **("Do gravitational fields play an essential role in the structure of elementary particles?"**) are proven correct one day. Then mass could result from photon-graviton interaction (this agrees with theories where the role of the Higgs field is fulfilled by particular couplings), and we could replace the m with zero. This results in $E=0*c^2$ ie outside familiar circumstances (perhaps in black holes or other dimensions), it is possible for E to equal 0. Having reduced the equation to nothing but E, m=0 and $c^2=0$ which means $m=c^2$. At first glance, $m=c^2$ seems to be saying mass exists at light speed. But the absence of E (energy) refers to there being no interaction of light energy and gravitational energy, and therefore no mass. If mass cannot be produced, Einstein's paper suggests mass-producing space-time/gravity must be described by zero. The zero-ness of space-time/gravity does not mean it doesn't exist … it obviously does. It means we can relocate matter and information superluminally, or travel into the past and future, because distance equals zero and can be eliminated from both space and time.

The following verifies that the Higgs particle's spin 0 can be formed by photon-graviton interaction. This begins with the description of spin in "A Brief History of Time" by Stephen Hawking – Bantam Press, 1988, pp.66-67. Professor Hawking writes,

"What the spin of a particle really tells us is what the particle looks like from different directions."

Spin 1 is like an arrow-tip pointing, say, up. A photon has to be turned round a full revolution of 360 degrees to look the same.

Spin 2 is like an arrow with 2 tips - 1 pointing up, 1 down. A graviton has to be turned half a revolution (180 degrees) to look the same.

Spin 0 is like a ball of arrows having no spaces between arrows. A Higgs boson looks like a dot: the same from every direction).

In this Thought Experiment, 1 is subtracted from 1 to produce the spin of the Higgs boson (0). Visualize a photon's spin as the first 1. Now visualize the continuous interaction of the long-range electromagnetic and gravitational forces in this manner: the photon makes a revolution that affirms its identity. Continuously interacting with the particle of electromagnetism, the graviton completes a second half-revolution and still looks the same (retains its identity). The second half-revolution is the second 1 in this paragraph's first line. Together with the first 1 it's subtracted from, it forms the spin 0 of the Higgs boson. In relation to particles of matter, division was used but in relation to the Higgs, subtraction is used. This is acceptable since division can be solved by repeated subtraction and the use

of 1 / 2 in both instances gives the fermions and bosons a form of symmetry. Photon spin is divided by graviton spin in the case of fermions, and the graviton completes half-revolutions (180 degrees) when speaking of bosons.

SECTION 3 -

MASS EQUATION, ENZYME ANALOGY, AND MATH'S CONNECTEDNESS

Mass – including the mentioned matter – is an emergent property resulting from (in simpler terms) photon-graviton interaction or, in more precise terms, virtual particles or BITS (BInary digiTS: $D_{subscript\ 1+0}$) interacting with the Mobius strip ($S_{sub\ M}$) and figure-8 Klein bottle ($K_{sub\ 8}$) which are assembled into interacting (via divided quantum spins) photons & gravitons that number in the trillions. In the maths notation adopted,

$$m = (D_{1+0}),\ (S_M,\ K_8),\ (n\ x\ 10^{12}.\gamma_s/G_s) \qquad \text{(equation 1)}$$

BITS part, TOPOLOGY part, INTERACTION part

Like a biological catalyst or enzyme, the strings of binary digits (1's and 0's) "bind to" and "hold in the proper position" the Mobius strip plus the figure-8 Klein bottle (these make up the substrate of reacting "chemicals"). The positioning is done by (a) uniting two Mobius strips to form each figure-8 Klein bottle, and (b) by changing the shape of the figure-8 Klein bottle. Informally - if an object in space consists of one piece and does not have any "holes" that pass all the way through it, it is called simply connected. A doughnut (and the figure-8 Klein bottle it resembles) is "holey" and not simply connected (they're multiply connected). Referring to the conceivably infinite universe - a flat universe that is also simply connected implies an infinite universe [Luminet, Jean-Pierre; Lachi`eze-Rey, Marc - "Cosmic Topology" - Physics Reports 254 (3): 135–214 (1995) arXiv:gr-qc/9605010]. So it seems the infinite universe cannot be composed of subunits called figure-8 Klein bottles (flat universes that are finite in extent include the torus and Klein bottle). But the changing of the Klein bottle's shape by gravitation and electromagnetism (these are composed of binary digits, also called virtual particles and hidden variables) mimics the process of gaps in, or irregularities between, figure-8 Klein bottles being "filled in" by

binary digits in the same way that computer drawings can extrapolate a small patch of blue sky to make a sky that's blue from horizon to horizon. This ensures the positive and negative shapes in different figure-8 Klein bottles are precisely united, and makes space-time relatively smooth and continuous as Einstein thought. Plus - it gets rid of holes, making figure-8 Klein subunits feasible. Since the S_M and K_8 are both mathematical shapes, $D_{(1+0)}$ must also be mathematical to interact with them. It uses the base-2 maths of binary digits, and interaction at this scale cannot be attributed to a lock-and-key mechanism of shapes fitting together.