Einstein's Missing Steps in E=mc2 and His Missing Link to Quantum Gravity

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Abstract -

E=mc2, General Relativity and Quantum Mechanics are the major themes of this article. Throughout the article, a few equations show the missing steps in E=mc2. These steps could not be included in the original equation because that was developed before things like superconductivity and wave-particle duality were discovered. Of course, things would be different if Einstein knew how to access Quantum Gravity or the Unified Field Theory he spent his last 30 years working on. A complete unified theory that includes everything in space-time (time is emphasized here) has practical applications. It gives us some understanding of the laws that govern the universe* - including the unknown (when E=mc2 was published in 1905) laws of superconductivity and wave-particle duality. The article starts with John Bardeen's comment that "The idea of paired electrons, though not fully accurate, captures the sense of it." He's referring to the mechanism by which superconductivity works (he shared in the 1972 Nobel Prize for Physics for this). That topic goes beyond paired electrons with wave-particle duality (which includes electromagnetic waves but also the paired electrons). The subsection on superconductivity ends with explanation of planetary magnetism and accounting for the electric fields of the planets.

*Mathematical and non-mathematical expression of that understanding can both contribute to knowledge. The progress of science does not depend on writing in a certain fashion, but on presenting insights clearly and in an extremely thorough and careful way. We might allow ourselves to think knowledge can only advance through the jargon and maths this tiny bit of history we live in calls scholarly writing. But then we merely validate what German physicist Max Planck (1858-1947) said: "A new scientific truth does not triumph by convincing its opponents and making them see the

light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it." — Max Planck, "Scientific Autobiography and Other Papers"

From there, it goes on to quantum-macroscopic union and speaks of gravitational / electromagnetic waves sharing properties with water waves. This leads to new interpretation of the motions of photons and gravitons (this is a new interpretation of 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). Such new motion deletes the concepts of universal expansion, dark energy and dark matter. Then a paper published by Albert Einstein in 1919 is mentioned which is titled "Do gravitational fields play an essential role in the structure of elementary particles?" (Prof. Wheeler's speculation that there's a relationship between geons and elementary particles supports this). Soon after the final formulation of general relativity, Einstein pointed out the need for a quantum modification of the theory. In later years, Einstein hoped a unified theory of electromagnetic and gravitational fields would explain the quantization of matter and energy. Both approaches appear valid. This article proposes that (1) the Wheeler–Feynman absorber theory and the Transactional Interpretation of Quantum Mechanics (TIQM) modify electromagnetic and gravitational waves to produce quantum modification, and (2) that electromagnetic and gravitational fields would be unified in the sense that the waves composing each field would possess both "retarded" and "advanced" components. The forwards and backwards movement can cancel to produce a quantum entanglement, and thus quantization. The result of this modification might well be modification of understanding of the strong and weak nuclear forces, as well as of the Higgs field. And if the ideas of TIQM-advanced/retarded waves should lead to someone developing a viable, formal theory of quantum gravity; that theory could test the idea of a relationship between geons and elementary particles.

Headings have been added which outline the basics of (a) the Higgs-gravity relation (even though such an idea is supposed to be completely wrong) and (b) how, using quantum spin of the photon and graviton, both

the Higgs boson and matter particles can be produced (the basic ideas behind production of the photons and gravitons themselves in a lab is explained, too). I've read that it is very hard to write down logically sound theories. My literal mind interprets this to mean mathematics is almost always essential. My mind also interprets it as a challenge – write down the science of spin interaction using plain English, with maths no more complex than 1 divided by a half.
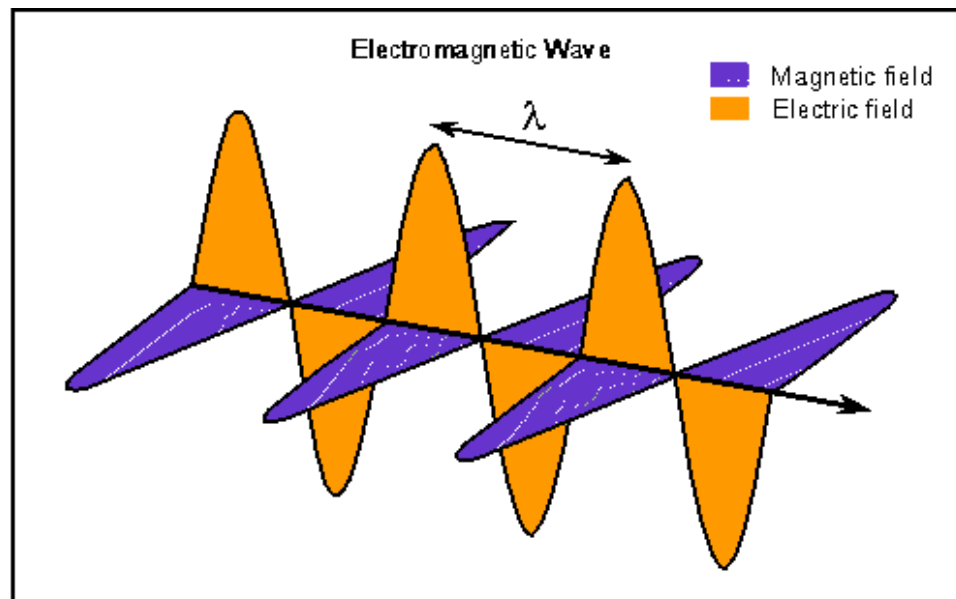
Content -

SUPERCONDUCTIVITY AND PLANETARY MAGNETIC / ELECTRIC FIELDS

Start with John Bardeen's comment that "The idea of paired electrons, though not fully accurate, captures the sense of it." (J. Bardeen, "Electron-Phonon Interactions and Superconductivity", in Cooperative Phenomena, eds. H. Haken and M. Wagner [Springer-Verlag, Berlin, Heidelberg, New York, 1973], p. 67). He's referring to the mechanism by which superconductivity works, for which he shared the Nobel Prize for Physics in 1972.

The Meissner effect (or Meissner–Ochsenfeld effect) is the expulsion of a magnetic field from a superconductor* during its transition to the superconducting state. The German physicists Walther Meissner and Robert Ochsenfeld discovered this phenomenon in 1933. Regarding the Meissner effect: Think of the electromagnetic wave relativistically. In General Relativity, the simple analogy of space-time being regarded as a rubber sheet is commonly used. Instead of resorting to complex and lengthy relativistic mathematics, we can simply picture an electromagnetic wave as a cylinder made of rubber. If 2 sides of the cylinder are pushed in with your fingers (say, the ones representing the electric component), the sides in the perpendicular direction (representing the magnetic component) will bulge outwards - this can be verified by placing a ruler behind the cylinder. Compressing the electric component will force the magnetic

component to bulge outwards ie there will be little or no magnetic field within the superconductor, only an external magnetic field. An externally-applied magnetic field also conforms to the bulging outwards and is expelled from within the superconductor.

* High temperature superconductors are known for not displaying the Meissner effect. The explanation below of planetary magnetic fields means, though the fields cannot be a product of the condensed-matter physics known as superconductivity, they might be considered a previously unrecognized variation of superconductivity, which is zero (electrical) resistance.

An electromagnetic wave showing electric and magnetic fields, and the wavelength (λ) which is the distance between crests of a wave.

Courtesy of nrao.edu

An electromagnetic wave can have its electrical part compressed through eg introduction of copper-and-oxygen compounds called cuprates or use of hydrogen sulfide (speaking of molecules as well as waves refers to

quantum mechanics' wave-particle duality). This means the explanation of superconductivity developed by John Bardeen, Leon Cooper, and John Schrieffer in 1957 (for which they shared the 1972 Nobel Prize) need not depend on the Cooper pair or BCS pair - a pair of electrons (or other fermions) bound together at low temperatures in a certain manner first described in 1956 by American physicist Leon Cooper. (Cooper, Leon N. (1956). "Bound electron pairs in a degenerate Fermi gas". Physical Review. **104** (4): 1189–1190). In a Cooper pair, an electron in a metal attracts the positive ions that make up the rigid lattice of the metal. This positive charge can attract other electrons, and it has also been recently demonstrated that a Cooper pair can comprise two bosons. ["Dynamical Creation of Bosonic Cooper-Like Pairs" by Tassilo Keilmann and Juan José Garcia-Ripoll: Phys. Rev. Lett. **100**, 110406 (2008)].

John Bardeen comments - "The idea of paired electrons, though not fully accurate, captures the sense of it." (J. Bardeen, "Electron-Phonon Interactions and Superconductivity", in Cooperative Phenomena, eds. H. Haken and M. Wagner [Springer-Verlag, Berlin, Heidelberg, New York, 1973], p. 67).

A more accurate description of superconductivity might refer to the following links. 'Physicists now believe that entanglement between particles exists everywhere, all the time, and have recently found shocking evidence that it affects the wider, "macroscopic" world that we inhabit.' ['The Weirdest Link' (*New Scientist*, vol. 181, issue 2440 - 27 March 2004, 32, http://www.biophysica.com/QUANTUM.HTM] Though the effect is measured for distances in space, the inseparability of space and time means that moments of time can become entangled too. (Caslav Brukner, Samuel Taylor, Sancho Cheung, Vlatko Vedral, 'Quantum Entanglement in Time', http://www.arxiv.org/abs/quant-ph/0402127) This link between the quantum and macroscopic worlds would unite the subatomic electrons of superconductivity with the wave motion in a pool of water. If a stone is dropped into a pool of calm water, many circular waves soon cover the surface of the water, and the water appears to be moving outwards from where the stone was dropped in. Actually, the particles of water simply rise then fall – it's the wave motion that moves outward. Similarly, the particles called paired electrons possess relatively little movement themselves – and

John Bardeen's comment about the idea of paired electrons not being fully accurate can mean that superconductivity is a wave motion.

Phrased informally, a more accurate description of superconductivity might refer to the illustration above of an electromagnetic wave. If compression is sufficient; the electric component no longer follows a long, curved path but its path is now linear and follows the shortest distance between two points. In other words, a superconductor that operates at room temperature and normal atmospheric pressure has been manufactured. Any resistance would, like a rock in the bed of a stream causing water to flow around it, lengthen the distance and mean the compound is not a perfect superconductor. This analogy to "a rock in the bed of a stream" refers to the relative non-movement of paired electrons. Superconductivity is a wave motion, where energy is transferred from one place to another without involving an actual transfer of matter.

"Magnetic Fields" (http://www.astronomynotes.com/solarsys/s7.htm) says, "Mercury's situation was a major challenge to the magnetic dynamo theory.* In true scientific fashion, the theory made a testable prediction: Mercury should have no magnetic field or one even less than Mars' one because its core should be solid. Observation, the final judge of scientific truth, contradicted the prediction. Should we have thrown out the magnetic dynamo theory then? Astronomers were reluctant to totally disregard the theory because of its success in explaining the situation on the other planets and the lack of any other plausible theory. Is their reluctance a violation of the objectivity required in science? Perhaps, but past experience has taught that when confronted with such a contradiction, nature is telling you that you forgot to take something into account or you overlooked a crucial process."

*The cause of Earth's magnetic field is said to be the geodynamo, also called the magnetic dynamo theory. The heat from the solid inner core puts the liquid outer core in motion, and the movements of the outer core's electrically conducting fluids (such as molten iron) generate the planet's magnetic field. Electrically conducting fluids occur in the Sun, other stars

and most planets – and are the scientifically accepted mechanism for magnetic fields.

The idea of compressed electric fields (they could be compressed by gravitational, or gravitational-electromagnetic, waves) and bulging, expelled magnetic fields is a very plausible alternative to Earth's geodynamo. It gains additional support by explaining why the planet Mercury has a significantly strong, apparently global, magnetic field (approx. 1.1% of Earth's).(1,2,3) Venus' core is thought to be electrically conductive and, although its rotation is often thought to be too slow, simulations show it is adequate to produce a dynamo. Simple reversal – compression of electromagnetism's magnetic component with expulsion of the electric component - means certain astronomical bodies, such as the planet Venus, could have no intrinsic magnetic field as a result. (It does have a much weaker one than Earth, induced by an interaction between the ionosphere and the solar wind).(4,5,6) ***But it would have a strong electric field – and the European Space Agency's Venus Express spacecraft did detect one.***(7) 'Scientists using Venus Express have identified another difference between the two planets: Venus has a substantial electric field, with a potential around 10 V. This is at least five times larger than expected. Previous observations in search of electric fields at Earth and Mars have failed to make a decisive detection, but they indicate that, if one exists, it is less than 2 V. "We think that all planets with atmospheres have a weak electric field, but this is the first time we have actually been able to detect one," says Glyn Collinson from NASA's Goddard Flight Space Center.' ("Venus Has Potential – But Not For Water" by the European Space Agency, 2016 (http://www.esa.int/Our_Activities/Space_Science/Venus_Express/Venus_has_potential_but_not_for_water)

Numbered references in above paragraph -

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[4] Luhmann, J. G.; Russell, C. T. (1997). "Venus: Magnetic Field and Magnetosphere". In Shirley, J. H.; Fainbridge, R. W. Encyclopedia of Planetary Sciences. New York: Chapman and Hall. pp. 905–907. ISBN 978-1-4020-4520-2

[5] "Caught in the wind from the Sun". European Space Agency. 28 November 2007

[6] Dolginov, Sh.; Eroshenko, E. G.; Lewis, L. (September 1969) "Nature of the Magnetic Field in the Neighborhood of Venus". Cosmic Research. **7**: 675

[7] "Electric Field at Venus" - http://sci.esa.int/venus-express/57967-electric-field-at-venus/ (2016)

How does this alternative account for magnetic-field reversals? The incoming gravitational waves can compress electric fields, resulting in a strong magnetic field. As motions in planetary cores occur, relocated electric waves can be compressed less, causing reduced expelling of the magnetic waves and weakening of Earth's field. Electromagnetic waves can change orientation by 180 degrees, causing the expelled magnetism's polarity to reverse.

CO-MOVEMENT OF PHOTONS AND GRAVITONS

The wave-particle duality described above can be described by starting with v=fλ (wave velocity equals frequency times Greek letter lambda which denotes wavelength). Velocity (speed in a constant direction) equals distance divided by duration. Since distance is a measure that has to do with space while duration is a measure that has to do with time, it equals space divided by time. (Brian Greene in "Speed", part of his "Space, Time and Einstein" course at

) Gravitational and electromagnetic wave motion (space-time motion) travels at c, the speed of light ie

v= fλ = distance/duration = space/time = c

A particle's velocity, whether the particle be a boson or fermion, is directly dependent on its energy – so it may be said that

E = v= fλ = distance/duration = space/time = c

This is not quite right since c represents energy alone, and space-time deals with mass-energy, so it's better to say

E = v= fλ = distance/duration = space/time = mc

What about the ^{2} in $E=mc^2$? In later papers Einstein repetitively stressed that his mass-energy equation is strictly limited to observers co-moving with the object under study. Co-movement is defined as:

An inertial frame of reference* which happens to be moving in the same direction, at the same speed, as an object or an accelerated frame which we're examining.
* A frame of reference is a system of geometrical axes in which the size, position or motion of something is described. "Inertial" means objects in the frame are not being accelerated - they are at rest or they move at a constant velocity in a straight line.

In order for $E=mc^2$ to apply to the universe (and it does), observers must be able to co-move with anything being studied (even a light beam). Moving in the same direction is no problem but how can anyone or anything move at the same speed? The link between the quantum and macroscopic worlds would do more than unite the subatomic electrons of superconductivity with the wave motion in a pool of water. It also means the transverse wave motion of electromagnetic waves is identical to the transverse wave motion in a body of water. Present-day observers can never move at the speed which light covers in the vacuum of space-time, so the only way for observers and light to co-move is for the nature of electromagnetism to be revised.

Like waves of water, electromagnetic waves are known as transverse. Consequently, the particles (photons) of light and microwaves etc that travel through space-time would have relatively little movement themselves. It's the disturbances from the sources of electromagnetism (shock waves of fluctuating amplitudes and frequencies) that travel. (They go through the fields of energy filling the so-called vacuum). Since E=mc^2 only applies to photons when they're at rest, the equation can only describe photons that have no motion in one direction – the horizontal "line of propagation" in which the shock wave moves. The photons can only move in the vertical direction, perpendicular to the shock wave – if they move at all. The formula then required to connect the photons and shock waves may be the extended version of Einstein's equation, called the relativistic energy–momentum relation.

$E^2=m_0^2c^4+p^2c^2$

("Dynamics and Relativity", J.R. Forshaw, A.G. Smith, Wiley, 2009, ISBN 978-0-470-01460-8, and "Physics" - https://physics.stackexchange.com/questions/6202/does-e-mc2-apply-to-photons)

As Paul Camp, Ph.D. in theoretical physics, writes at https://www.quora.com/How-big-is-a-photon -

"A photon is a quantum of excitation of the electromagnetic field. That field fills all space and so do its quantum modes."

This is consistent with energy being transferred from one place to another (as wave motion) without involving an actual transfer of particles (little or no movement of photons). General Relativity says gravitation IS space-time ie the gravitational field also fills all space, so the seeming motion of gravitational waves could also be due to fluctuations of shock waves' amplitudes and wavelengths causing excitations (called gravitons) in the field. These excitations cover 186,282 miles every second. (Savard, J. "From Gold Coins to Cadmium Light". John Savard. WebCite: http://www.quadibloc.com/other/cnv03.htm on 2009-11-14: The speed of light is based on an inch of exactly 2.54 cm and is exactly 186,282 miles, 698 yards, 2 feet, and 5 21/127 inches per second.)

The above ideas of gravitational and electromagnetic waves displaying little or no motion are a new interpretation of 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.

NO COSMIC EXPANSION, NO DARK ENERGY, NO DARK MATTER

If there's little or no movement of photons and gravitons, the universe could not be expanding. And non-expansion eliminates the need for repelling Dark Energy that makes the universe expand. Here's a bit more supporting those ideas (the first part deals with the Cosmic Microwave Background and the second part with Redshift) –

Edwin Hubble (1889-1953), the astronomer credited with discovering cosmic expansion, remained doubtful about the expansion interpretation for his entire life. He believed "expanding models are a forced interpretation of the observational results." ("Effects of Red Shifts on the Distribution of Nebulae" by E. Hubble, Ap. J., 84, 517, 1936). According to astronomer Allan Sandage, "Hubble believed that his count data gave a more reasonable result concerning spatial curvature if the redshift correction was made assuming no recession. To the very end of his writings he maintained this position, favouring (or at the very least keeping open) the model where no true expansion exists, and therefore that the redshift "represents a hitherto unrecognized principle of nature." [Sandage, Allan (1989), "Edwin Hubble 1889–1953", The Journal of the Royal Astronomical Society of Canada, Vol. 83, No.6]

The great majority of scientists will simply dismiss Hubble's concerns because they agree that discovery of the Cosmic Microwave Background (CMB) in 1964 by American radio astronomers Arno Penzias and Robert Wilson proved the universe is expanding from the Big Bang. (Penzias, A. A.; Wilson, R. W. [1965]. "A Measurement of Excess Antenna Temperature at 4080 Mc/s". The Astrophysical Journal. 142 [1]: 419–421). Explanation

of why this isn't so is best addressed in the next subheading. That subheading deals with the necessity for a quantum modification which was pointed out by Einstein, and gives us the sentence "The quantum entanglement of microwaves with all of space-time means the Cosmic Microwave Background radiation fills the entire sky and is not produced by the Big Bang as most scientists believe (quantum entanglement has been repeatedly confirmed experimentally)."

Now for a few words about redshift - according to General Relativity, gravity does not exist in space-time but IS space-time. The acceleration known as cosmic expansion is offset by the relativistic proposal that the space-time composing the cosmos IS gravitation. In astrophysics, gravitational redshift or Einstein shift is the process by which electromagnetic radiation originating from a source that is in a gravitational field is reduced in energy and in frequency / increased in wavelength, or redshifted to the red end of the spectrum. Since gravity is just another term for the curvature of space-time, the gravitational field responsible for a particular example of electromagnetic radiation and redshift is not limited to a particular galaxy or galaxy cluster but spans (indeed, is) the whole of space-time.

The farther away a galaxy is, the greater is the amount of gravitation which any electromagnetic radiation has to traverse. So the electromagnetism weakens more than expected and the gravitational redshift, which is larger than anticipated, naturally increases with distance. All of the redshift not due to the Doppler effect is gravitational redshift, which is always grounded in space-time-spanning gravity. It never indicates universal expansion, which would make it what is called cosmological redshift and would require space-time and gravitation to be separate things.

This gravitational redshift can be applied to anything and everything, including the type 1a supernovae used by the Supernova Cosmology Project and the High-Z Supernova Search Team when they supposedly discovered accelerating expansion of the universe in 1998 (they compared the stars' brightnesses with their measured redshifts, and attributed the apparent expansion to dark energy). (Overbye, Dennis [20 February 2017].

"Cosmos Controversy: The Universe Is Expanding, but How Fast?" New York Times)

Nor does Dark Matter seem to be necessary. General Relativity says gravity is a push exerted by the curvature of space-time. Here are 3 physicists who agree - According to James Overduin, a physicist at Towson University in Maryland, USA who specializes in gravitation - gravity is just another term for the curvature of space-time. To quote from the article "Gravitation" by Robert F. Paton, MS PhD in "The World Book Encyclopedia" (Field Enterprises Educational Corporation, 1967): "(Bodies) merely follow the line of least resistance through the hills and valleys of the curved space that surrounds other bodies. Objects that fall to the earth, for example, are not "pulled" by the earth. The curvature of space-time around the earth forces the objects to take the direction on toward the earth. The objects are pushed toward the earth by the gravitational field rather than pulled by the earth." (I've also heard the modern physicist Michio Kaku agree that gravity is a push.)

The first formal inference about the existence of dark matter ("The redshift of extragalactic nebulae", Fritz Zwicky's first paper on this topic, appeared in 1933 in the obscure journal Helvetica physica acta, vol. 6, p. 110) said that some unseen matter provided the mass and associated gravitation to hold the Coma cluster of galaxies together. A galaxy or galaxy cluster would indeed tend to fly apart if its gravitation is considered to be a pull from its centre that weakens with the distance to its edge.* But thinking of general relativity's definition of gravity as a push means the galaxy's or cluster's edges are being pushed towards its centre, thus holding it together. Galactic shrinkage is offset by the orbiting speeds of bodies and / or Einstein's paper that was written 4 years after General Relativity was published - "Do gravitational fields play an essential role in the structure of elementary particles?" ("Spielen Gravitationsfelder im Aufbau der materiellen Elementarteilchen eine wesentliche Rolle?" by Albert Einstein - Sitzungsberichte der Preussischen Akademie der Wissenschaften, [Math. Phys.], 349-356 [1919] Berlin). His paper suggests electromagnetism is the other contributor. (Prof. Wheeler's speculation that there's a relationship

between geons - electromagnetic or gravitational waves held together in a confined region by their own nature - and elementary particles supports this.)

* The inverse-square law says that if stars A and B emit light of equal intensity but star B is twice as distant, it will appear one quarter as bright as star A i.e. as the inverse square of 2 (1/4). It also says the gravity between any 2 objects is only one quarter as strong if the distance between the objects doubles.

THE RELATION OF THE HIGGS FIELD TO GRAVITY

Regarding Einstein's 1919 paper, it's certainly true that general relativity plus electromagnetism in their present forms cannot explain the existence and stability of elementary particles. Einstein showed that it is necessary to modify General Relativity's gravitational field equations (soon after the final formulation of general relativity, he pointed out the need for a quantum modification of the theory). ("ViaLibri – The World's Largest Marketplace for Old, Rare & Out-of-Print Books": https://www.vialibri.net/years/items/1338292/1919-einstein-albert-spielen-gravitationsfelder-im-aufbau-der-materiellen). Therefore, the future quantum modification of gravitation and electromagnetism could, possibly, prevent galactic shrinkage because the waves are weakened during their role of building up the structure of elementary particles. And possibly, during formation of particles' associated strong and weak nuclear forces.

This refers to theories where the role of the Higgs field is fulfilled by particular couplings (in this case, of the graviton and photon - see M. Tanabashi; M. Harada; K. Yamawaki. Nagoya 2006: "The Origin of Mass and Strong Coupling Gauge Theories". International Workshop on Strongly Coupled Gauge Theories. pp. 227–241). In connection with the proposed Higgs field: "to justify giving mass to a would-be massless particle, scientists were forced to do something out of the ordinary. They assumed

that vacuums (empty space) actually had energy. That way, if a particle that we think of as massless were to enter it, the energy from the vacuum would be transferred into that particle, giving it mass." (Wikipedia - Higgs field - Reason for Higgs effect). This means the Higgs field cannot be separate from the universal Gravitational - ElectroMagnetic (GEM) field. If it was, massless gravitons and photons would enter the Higgs field and become massive. Since they're the same thing, graviton-photon interaction can be called the Higgs field if that term is preferred.

References Wikipedia provided -

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Without going into formal theory ourselves, we can use the conclusions derived from the quantum and mathematical theories of others to make an educated guess as to what the future quantum modification of gravitation and electromagnetism will be -

the existence of both advanced waves (which travel backwards in time) and retarded waves (which travel forwards in time) as admissible solutions to James Clerk Maxwell's equations about electromagnetism was explored in

the Wheeler–Feynman absorber theory last century, as well as in the more recent transactional interpretation of quantum mechanics (TIQM). Einstein's equations say gravitational fields carry enough information about electromagnetism to allow Maxwell's equations to be restated in terms of these gravitational fields. This was discovered by the mathematical physicist George Yuri Rainich. [George Yuri Rainich, *Transactions of the American Mathematical Society*, 27, 106 - Rainich, G. Y. (1925)] Therefore, gravitational waves also have a 'retarded' component and an 'advanced' component. They can travel forward or backward not only in space, but in time too.

17th century scientist Isaac Newton's idea of gravity acting instantly across the universe could be explained by gravity's ability to travel back in time, and thereby reach a point billions of light years away not in billions of years, but in negative billions-of-years. That is; the negative/advanced component of a gravitational wave would already be at its destination as soon as it left its source, and its journey is apparently instant. Instantaneous effect over large distances is known as quantum mechanics' entanglement and has been repeatedly verified experimentally. If the retarded (forwards) wave component travels in positive space, the advanced (backwards) component corresponds to an equal amount of negative distance. The forwards and backwards movement in time can potentially cancel to produce a quantum (and macroscopic) entanglement that eliminates the need for the Big Bang's and Cosmic Inflation's solution that the universe is roughly the same everywhere on large scales because everything was once in contact in a tiny space. And if the ideas of TIQM-advanced/retarded waves should lead to someone developing a viable, formal theory of quantum gravity; that theory could test the idea of a relationship between geons - electromagnetic or gravitational waves held together in a confined region by their own nature - and elementary particles.

The quantum entanglement of microwaves with all of space-time means the Cosmic Microwave Background radiation fills the entire sky and is not produced by the Big Bang as most scientists believe (quantum entanglement has been repeatedly confirmed experimentally). For more

about entanglement, see 'The Weirdest Link' (*New Scientist*, vol. 181, issue 2440 - 27 March 2004, 32, http://www.biophysica.com/QUANTUM.HTM) and 'Quantum Entanglement in Time' by Caslav Brukner, Samuel Taylor, Sancho Cheung, Vlatko Vedral, http://www.arxiv.org/abs/quant-ph/0402127.

As far as I can tell, the Higgs field is so weak because it's a manifestation of the extremely weak gravitation filling the universe. This is despite physicist Matt Strassler's 2012 article "Why the Higgs and Gravity are Unrelated" (https://profmattstrassler.com/2012/10/15/why-the-higgs-and-gravity-are-unrelated/). Despite all his attention to maths and scientific detail, Prof. Strassler makes an inexplicable claim. He says there is no "mathematical connection between gravity and the Higgs field" partly because "gravitational fields … are described as part of space and time". According to James Overduin, a physicist at Towson University in Maryland, USA who specializes in gravitation - General Relativity states gravity is just another term for the curvature of space-time ie gravity is not part of space-time: it IS space-time. Prof. Strassler undoubtedly simply had a brief lapse in his attention to detail, but the lapse leads to my conclusion that there indeed is a mathematical connection between gravity and the Higgs field. By itself, this lapse is not a good enough reason to dismiss Prof. Strassler's maths and details.

To show a connection between gravity and the Higgs field, more is necessary than saying gravity is not part of space-time: it IS space-time. We must consider the complete sentences in "Why the Higgs and Gravity are Unrelated". They are "Gravitational fields have spin 2 and are described as part of space and time; they interact with all particles and fields in nature. The Higgs field, which has spin 0, only interacts directly with elementary particles and fields that also participate in the electromagnetic and weak nuclear forces." In Prof. Strassler's words,

"The majority of the mass of an atom is its nucleus, not its lightweight electrons (elementary particles) on the outside. And nuclei are made from protons and neutrons (composite particles) — bags of imprisoned or "confined" quarks, antiquarks and gluons. These quarks, antiquarks and

gluons go roaring around inside their little prison at very high speeds, and the masses of the proton and neutron are as much due to those energies, and to the energy that is needed to trap the quarks etc. inside the bag, as it is due to the masses of the quarks and antiquarks contained within the bag. **So the proton's and neutron's masses do not come predominantly from the Higgs field.**" From <https://profmattstrassler.com/2012/10/15/why-the-higgs-and-gravity-are-unrelated/>

A complete, not merely partial, connection between gravity and the Higgs field requires explanation of quantum spins (taking up the challenge of attempting to write down a logically sound hypothesis, this will now be done non-mathematically).

SPIN INTERACTIONS AND MAKING BOSONS OR FERMIONS

This begins with the description of spin in "A Brief History of Time" by Stephen Hawking – Bantam Press, 1988, pp.66-67. Prof Hawking writes,

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

From <https://www.tapatalk.com/groups/vixra/viewtopic.php?f=3&t=666&p=1354&hilit=Bartlett+spin>

Spin 1 (like an arrow-tip pointing, say, up: a photon has spin 1).

Has to be turned round a full revolution of 360 degrees to look the same.

Spin 2 (like an arrow with 2 tips - 1 pointing up, 1 down: a graviton's spin).

Turned half a revolution (180 degrees), it looks the same.

Spin 0 (like a ball of arrows having no spaces between arrows, particles with spin 0 look like a dot: the same from every direction).

The Higgs boson has spin 0.

Spin 1/2 This is the spin of matter particles such as the proton, neutron, electron, neutrino and quark. (Author's opinion: I think they look like a Mobius Strip).*

*These particles must be turned through 2 complete revolutions to look the same, and you must go round a Mobius twice to reach your starting point.
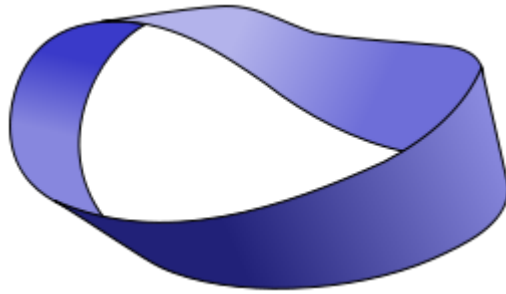

To produce the spin of matter particles (1/2) from the photon (1) and graviton (2), 1 is divided by 2. Photon/graviton may equal distance/duration ie the revised electromagnetism above with shock waves (horizontal distance) and rising or falling spin-1 photons (vertical distance) divided by the time taken to traverse part of the universe's gravitational field (composed of spin-2 gravitons).

To produce the spin of the Higgs boson (0), 1 is subtracted from 1. Visualize a photon's spin (the first 1) as a playing card connected to another card, which represents a graviton. The connection might be pictured as a nail punched vertically through the middle of one card and into the centre of the other: the connection represents the continuous interaction of the long-range electromagnetic and gravitational forces filling space-time. The photon card pulls the graviton card around with it while making a revolution that affirms its identity. During this, 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 its subtracted from, it forms the 0 revs and spin 0 of the Higgs boson. Einstein's hoped-for gravitational-electromagnetic unification is achieved by adding photons and gravitons. However, he never found the quantum modification he sought. So the quantum interaction and entanglement accomplished via advanced and

retarded waves or the Transactional Interpretation of Quantum Mechanics is better described as subtracting gravitons from photons.

Mobius Loop (source: http://www.polyvore.com/mobius_strip_public_domain_clip/thing?id=72360021)

There are 4 scientists I know of that support the idea of the universe being composed of information/mathematics:

1) In 1990, John Wheeler (1911-2008) suggested that information is fundamental to the physics of the universe. According to this "it from bit" doctrine, all things physical are information-theoretic in origin. (Wikipedia's description of *Wheeler, John A. (1990). "Information, physics, quantum: The search for links". In Zurek, Wojciech Hubert. Complexity, Entropy, and the Physics of Information. Redwood City, California: Addison-Wesley.*

2) Erik Verlinde says gravity is not a fundamental force of nature, but an emergent phenomenon. In the same way that temperature arises from the movement of microscopic particles, gravity emerges from the changes of fundamental bits of information, stored in the very structure of spacetime. ["Emergent Gravity and the Dark Universe" by E. P. Verlinde, 7 Nov 2016 (arxiv.org/abs/1611.02269)]

3) Cosmologist Max Tegmark hypothesizes that mathematical formulas create reality – ["Our Mathematical Universe" by Max Tegmark – Random House/Knopf, January 2014]

4) "Pioneered (in the late 1980's) by Rafael Sorkin, a physicist at the Perimeter Institute in Waterloo, Canada, the theory (causal sets) postulates that the building blocks of space-time are simple mathematical points that

are connected by links, with each link pointing from past to future."
["Theoretical physics: The origins of space and time" by Zeeya Merali
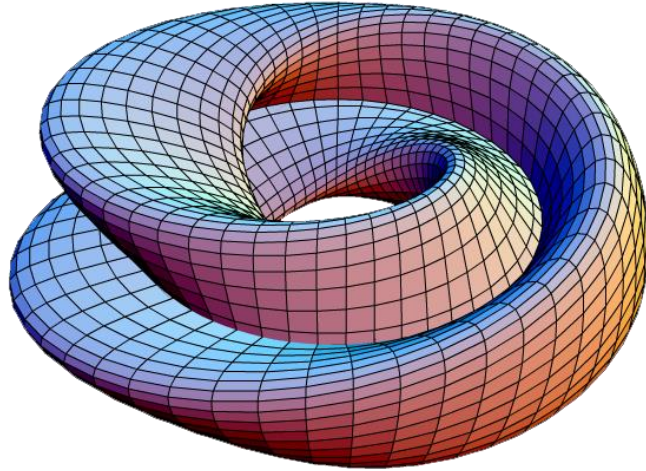("Nature" **500**, 516–519 – 28), August 2013]

Recalling John Bardeen's statement on superconductivity, "(Revolution in quantum spin), though not fully accurate, captures the sense of (spin)". "The quantum spin of a particle cannot be explained in terms of classical rotation since it can only have certain values that are equal to either a whole number or half a whole number multiplied by *Planck's constant* h - ratio of a photon's energy to its frequency - divided by 2(pi) (a quantity called h-bar): "Quantum" by Manjit Kumar (Icon Books, 2008). It seems plausible that the particular values of spin could be determined by another set of particular values viz those in electronics' binary digits, which always take the form of either 1 or 0. If a subatomic particle of matter really does look like a Mobius strip, this - when combined with the previous sentence - is a clue as to how to make particles (of light and gravity, as well as matter). First, the 1's and 0's are programmed to form the shape of a Mobius strip, which is merely two-dimensional (2-D). The recent science paper "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. ("Holographic" could refer to the interference between gravitational and electromagnetic waves, while "2D packages trillions of times smaller than an atom" could refer to Mobius strips.)

Then two strips must be joined to make a 4-D Klein bottle which has length, width, depth and the 4th dimension of movement in time: "Imaging maths - Inside the Klein bottle" by Konrad Polthier (http://plus.maths.org/content/os/issue26/features/mathart/index). 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 the flat curvature of space-time ("The WMAP science team has nailed down the curvature of space to within 0.4% of 'flat' Euclidean." - "Wilkinson Microwave Anisotropy Probe" - https://map.gsfc.nasa.gov/). Like the pommel protruding from the front of a saddle, negative curvature can cause an "imaginary" space – and thanks to the indissoluble union of spatial plus temporal phenomena, "imaginary" time*; to extend 90 degrees from the "surface" of real, flat space-time. When you have trillions of Mobius and figure-8 Klein elements assembled, an appropriate number of photons and gravitons must be included to give it what we call mass. You can make massless photons and electromagnetic fields by omitting gravitons and changing programming of spin from 1/2 to 1. Massless gravitons and gravitational fields can be made by omitting photons and programming spin values that are 2/1 instead of 1/2.

*Professor Itzhak Bars of the University of Southern California in Los Angeles says, 'one whole dimension of time and another of space have until now gone entirely unnoticed by us'. (Tom Siegfried, 'A Two-Time Universe? Physicist Explores How Second Dimension of Time Could Unify Physics Laws', May 15 2007 https://m.phys.org/news/2007-05-two-time-universe-physicist-explores-dimension.html) Could Prof. Bars' second dimension of space be imaginary (in the sense of i = √-1) space which is united with imaginary time the same way ordinary space and time are joined? And in the unification of a quantum gravity universe, the real and imaginary would be connected.

Figure-8 Klein Bottle (source: http://commons.wikimedia.org/wiki/File:KleinBottleFigure8-01.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/eternity.

The Higgs field is thus weak like gravity. In fact, it may have no independent existence from the gravitational field. In connection with the proposed Higgs field: "to justify giving mass to a would-be massless particle, scientists were forced to do something out of the ordinary. They assumed that vacuums (empty space) actually had energy. That way, if a particle that we think of as massless were to enter it, the energy from the vacuum would be transferred into that particle, giving it mass." (Wikipedia - Higgs field - Reason for Higgs effect). This means the Higgs field cannot be separate from the universal Gravitational - ElectroMagnetic (GEM) field. If it was, massless gravitons and photons would enter the Higgs field and become massive. Since they're the same thing, graviton-photon interaction can be called the Higgs field if that term is preferred. Different proposed measurements for the Higgs and gravitational fields are expected because the gravitational field which fills space-time is perpetually interacting with the electromagnetic field that also fills space-time. This article therefore refers to theories where the role of the Higgs field is fulfilled by particular couplings (in this case, of the graviton and photon - see M. Tanabashi; M. Harada; K. Yamawaki. Nagoya 2006: "The Origin of Mass and Strong Coupling Gauge Theories". International Workshop on Strongly Coupled Gauge Theories. pp. 227–241).

THE FINAL MISSING STEP IN E=mc^2

Since Einstein's mass-energy equation is strictly limited to observers co-moving with the object under study, $E=mc^2$ becomes a cosmological constant (G, the gravitational constant, is another) and ^{2} must be added to the mass/light-speed part of this article's equation -

$E = v = f\lambda = distance/duration = space/time = mc^2$

Simplified by removal of the middle elements, this becomes $E=mc^2$

(any other result would suggest the inventor of Relativity was wrong).