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Unveiling the Interconnected Paradigms of Quantum Entanglement and Special Relativity

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Abstract -

A few years ago, I first posted these ideas of mine online as preprints and have been developing the details since then. The earliest record I can find about writing on Mobius strips and matrix mathematics in relation to higher dimensions is an article in May 2018 at http://vixra.org/pdf/1805.0073v3.pdf. A couple of days ago, I started thinking deeply about the role of neutrons in atoms. Then yesterday, I saw Karl Kruszelnicki, who's known as Dr. Karl, on TV talking about higher dimensions and neutron decay. This reminded me of my earlier writings - and I put together the present article combining neutrons with Mobius strips, quantum spin, Earth's tides, M-sigma, Saturn's moon Enceladus, geometry, matrix mathematics, dark matter, dark energy, and higher dimensions. It also seemed necessary to add thoughts about binary digits, topology, supersymmetry, and Wick rotation's proposed function in Special Relativity and quantum entanglement.

Abstract of bonus section -

This bonus section was inspired by the astronomy/astrophysics course "Greatest Unsolved Mysteries of the Universe". It was prepared by ANU (the Australian National University), was put on the Internet by edX, and the two presenters in the course's videos are Dr. Paul Francis and Brian Schmidt (yes, the co-winner of the 2011 Nobel Prize for Physics himself).

In the video "V5.8**:** 21 centimetre radiation and the first stars", Brian said

"(To get emission from the hydrogen atom) we're going to have to resort to a little trick of quantum mechanics that is provided for the hydrogen atom, which is that the proton and electron within quantum mechanics have a spin. It's analogous to a top spinning. It turns out that the hydrogen atom has a different energy if those spins are in opposite directions. It turns out it actually has a lower energy and so you can have an energy transition when that flip occurs and a photon comes out."

Then Paul said,

“It's a bit like having two bar magnets. If you have them with north pole to north pole, or north pole to south pole, you'll feel a different amount of force between them; a different energy between these two things. When these things are spinning the same way or the opposite way there's a little tiny energy difference between them.”

The following explains analogy of quantum spin to maths’ matrix and how, using that analogy, the statements by Brian and Paul can be converted into a mathematical origin of electromagnetism and gravitation.

Keywords -

Higher dimensions, neutrons, Mobius strips, quantum spin, Earth’s tides, M-sigma, Saturn’s moon Enceladus, vector-tensor-scalar geometry, matrix mathematics, gravitational waves, electromagnetic waves, dark matter, dark energy, Wick rotation, Special Relativity, quantum entanglement, quantum spin, mathematics’ matrix, math origin of electromagnetism, math origin of gravitation, photon, graviton, magnetism

BITS AND TOPOLOGY

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

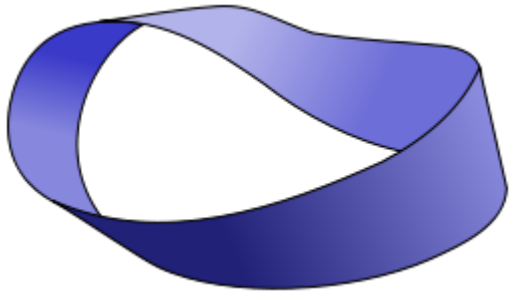
a) In 1990, John Wheeler (1911-2008) suggested that information is fundamental to the physics of the universe. According to this "it from bit" doctrine, all things physical are information-theoretic in origin. (1)
b) Erik Verlinde says gravity is not a fundamental force of nature, but an emergent phenomenon. 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 space-time. (2)
c) Cosmologist Max Tegmark hypothesizes that mathematical formulas create reality. (3)
d) “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." (4)

Stephen Hawking writes, "What the spin of a particle really tells us is what the particle looks like from different directions." (5) Particles of matter like the proton and electron have spin 1/2, which means these particles must be turned through two complete revolutions to look the same – and, not coincidentally, you must go around a Mobius strip twice to reach your starting point. This is an excellent starting point in the quest to unify electromagnetism and gravitation, since it tells us that the Mobius strip is a basic, fundamental unit of reality. **It seems plausible that the particular values of quantum 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. (Electronics could thus insert Artificial Intelligence and defiance of the Uncertainty Principle into everything from the subatomic scale through the biological to the astronomical.)** First, the 1's and 0's are programmed to form the shape of a Mobius strip, which is merely two-dimensional (2-D). To use words from a recent paper -

In a holographic universe, all of the information in the universe is contained in 2D packages trillions of times smaller than an atom.(6)

(Just as the interference between two laser beams produces a three-dimensional holographic image, "holographic" would also have the accepted cosmological meaning of the entire universe being seen as two-dimensional information – from Mobius strips, according to this article - projected into the three dimensions we're familiar with.)

Figure 1 - MOBIUS STRIP (source: http://www.clker.com/cliparts/3/7/a/9/12205465347817139 51lummie_Mobius_Strip.svg.hi.png)

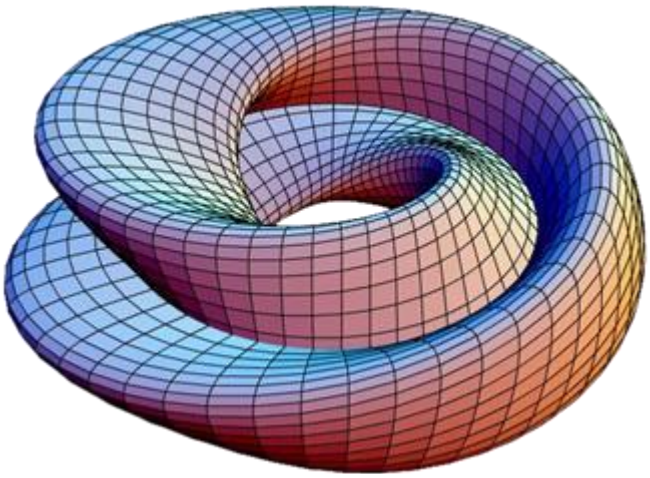


Then two strips must be joined to make a 4-D Klein bottle (7) which has length, width, depth and, when Wick rotation is programmed^ into the strips as a subroutine (see Figure 3), the 4th dimension of movement in time. The type of Klein bottle formed would appear to be the figure-8 Klein. A diagram of 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 (8). When you have trillions of Mobius and figure-8 Klein elements assembled, you can follow the theory of the mass-giving Higgs field being the result of various couplings. This theory has lost popularity since the Higgs boson was discovered. But an implication of a 1919 paper by Einstein is that the coupling is between gravitons and photons. Here, that coupling's slightly modified to between the Mobius strip and the figure-8 Klein bottle (these exist on a level between photons/gravitons and 1's/0's, being built up into the particles and composed of the binary digits). With trillions of Mobius and figure-8 Klein elements assembled, these trillions (respectively called photons and gravitons) give the matter what we call the emergent property of mass - similar to hydrogen and oxygen combining to give water what we call wetness. (Subatomic particles must possess quantum mechanical waveparticle duality if they're composed of gravitational plus electromagnetic waves. Duality also says waves possess particle-like properties ie the waves are composed of gravitons and photons.)

^ In a science TV program, (9) Dr. Graham Phillips reported that "the physicist and writer Paul Davies thinks the universe is indeed fine-tuned for minds like ours. And who fine-tuned it? Not God but minds from the future, perhaps even our distant descendants, that have reached back through time ... and selected the very laws of physics that allow for the existence of minds in the first place. Sounds bizarre, but quantum physics actually allows that kind of thing."

Figure 2 - 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.)



Science seems to avoid infinity at all costs – equating it with zero will give scientists many more headaches. Maybe they could accept infinity if ∞=0 is viewed as the ultimate form of renormalization – a renormalization that doesn't reduce the infinite size of the universe but, thanks to $E=mc^2$, reduces the distances in space and between times to zero. E=mc^2 seems to tell us that all distances in space, and time, can be completely eliminated (permitting us to instantly reach anywhere in spacetime). Einstein wrote a 1919 paper titled "Do gravitational fields play an essential role in the structure of elementary particles?" (it suggests electromagnetism is the other contributor to mass). Today's world answers the paper's question with "no" but, out of curiosity, let's ask what happens if the answer is "yes". Since photons and gravitons exist everywhere in space-time, they can interact without motion from one spot to another ($E=mc^2$ only applies to motionless photons). Let's represent the masslessness of gravitons and photons by 0 and substitute that for m (mass) in $E=mc^2$. The masslessness of interacting photons and gravitons results in E=0*c^2 ie in bizarre physics like black holes, E can equal 0. Having reduced the equation to nothing but E, m=0 and c^2=0 which means m=c^2. The absence of E (energy)

refers to there being no interaction of electromagnetic and gravitational energy, and therefore no mass. If mass cannot be produced, Einstein's paper implies massproducing space-time/gravity must be zero. It obviously exists, so its zero-ness can mean we can relocate matter and information superluminally, or travel into the past and future, because distance can equal zero and can be eliminated from both space and time. An additional meaning of space-time/gravity equaling zero is that the constant value states the universe cannot be expanding or contracting (an entire eternally infinite universe can never expand or contract). Also, the universe can neither expand nor contract because photons and gravitons can be at rest in an electromagnetic or gravitational wave, never expanding or reducing their region of influence.

SUPERSYMMETRY AND WICK ROTATION

Following Albert Einstein's example of turning Max Planck's quanta (which, for years, Planck and all other scientists considered purely mathematical) into explanation of the physical photoelectric effect, the Wick rotation used to describe imaginary time may be transformed from mathematical "trickery" to physical meaning, and provide a modern way to unite space and time (and imaginary space-time's Dark Matter) into one spacetime.

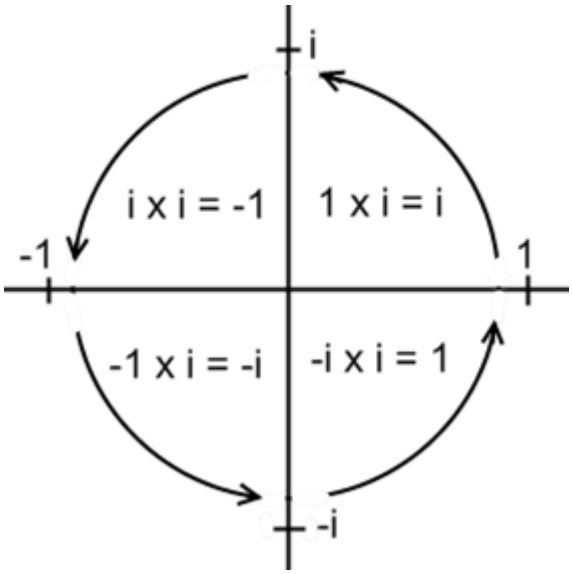


Figure 3 – WICK ROTATION: "The complex plane reveals i's special relationship with cycles via the circle of i, also known as Wick rotation. Whenever a point on the complex plane is multiplied by i, it moves a quarter rotation around the origin or center of the plane."(10)

This submission claims Mobius strips compose energy particles as well as matter particles (see Footnote 1) and the Wick rotation inherent in the strips is adaptive. There are vastly increased numbers of gravitational energy's gravitons near black holes, and there is increased effect on electromagnetic energy's photons when speed-of-light travel includes vast numbers of photons in the traveller's sphere of influence. These enlarged quantities boost the probability of Wick rotations cancelling to produce quantum entanglement. "Advanced" waves travel back in time (to the left of Fig. 3's origin or centre). "Retarded" waves go forwards in time (to the right of Fig. 3's centre). Imagine the wave

below as a retarded wave originating at the red dot on the far left. As it rotates around the origin in Fig. 3's anticlockwise direction to occupy coordinates proceeding to the left of the origin, its crests become troughs and troughs become crests (the other red dots mark the straight lines of the axes). In this way, the crests and troughs cancel each other and cancellation produces quantum mechanics' entanglement. In other words, a wave interferes with itself (and a particle - whether boson or fermion - formed from gravitational and electromagnetic waves interacts with itself). This is demonstrated by the Mach-Zehnder interferometer.

Figure 4 – Wave (Public domain image from https://en.wikipedia.org/wiki/Wave#/media/File:Standing_wave.gif)

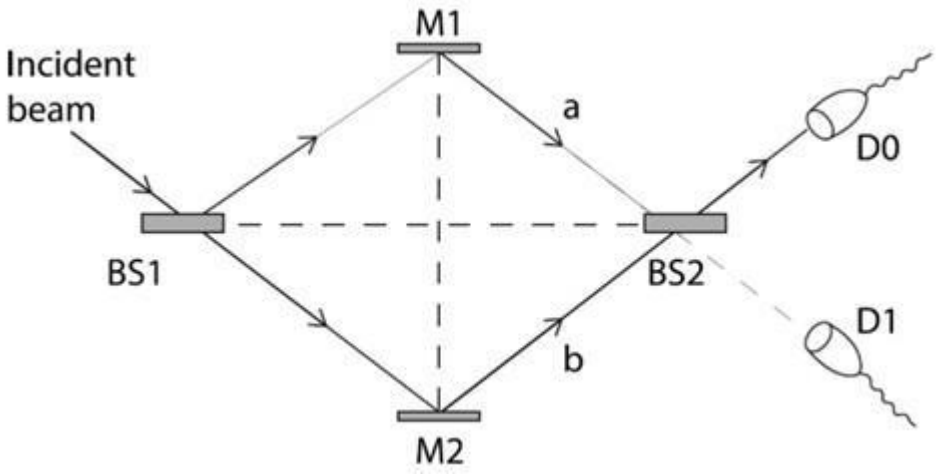


Figure 5 - Mach-Zehnder interferometer

We have two beam splitters (BS1 and BS2) and two perfect mirrors (M1 and M2). An incident beam coming from the left is split at BS1 and recombines at BS2, which sends two outgoing beams to the photon detectors D0 and D1. The interferometer can be set up to produce a precise interference effect which ensures all the light goes into D0, as shown above. Alternatively, the setup may be altered to ensure all the light goes into D1.

(Source of figure and figure's text - "Reading Feynman" by Jean Louis Van Belle: https://readingfeynman.org/tag/interference-of-a-photon-with-itself/. His reference for the illustration is MIT edX Course 8.04.1*x* (Quantum Physics), Lecture Notes, Chapter 1, Section 4 (*Quantum Superpositions*).

As well, an effect of gravitational and electromagnetic waves following Wick rotation is to cause cancelling crests and troughs to produce Special Relativity's time dilation (slowing - with eventual stoppage at the speed of light) near the intense gravity of black holes, and near light speed. They also move the idea of waves travelling back in time into accepted science.

According to the geometry in Section 1, both matter and dark matter can be formed by the interaction of gravitation and electromagnetism. The only difference between them would be that dark matter is, to use Wick rotation, rotated 90 degrees from ordinary matter's horizontal x-axis to the vertical, "imaginary" y-axis. It's rotated into another dimension. Since this rotation twists the electromagnetic spectrum perpendicular to our perceptions and instruments, the dark matter is only detectable gravitationally (because it still resides in space-time and General Relativity says gravity is the curvature of spacetime; therefore, gravity is space-time). Though unified with this dimension, it may be visualized as existing "above" and "below" ordinary space-time**:** in "hyperspace" and "subspace". **Following Einstein's $E=mc^2$, the relation between Dark Matter (DM) and the Dark Energy it possesses (DE) would be $DE=DMc^2$.** In conclusion**;** if the gravitons and photons are entangled, so are the figure-8 Klein bottles and Mobius strips and Wick rotations that compose the particles.

Supersymmetry (SUSY) proposes a relationship between bosons and fermions. Some scientists believe supersymmetry is a failed theory. A new approach would be proposing that the Mobius strip is a fundamental constituent of not only fermions (particles of matter) but also of bosons (particles of energy) - and therefore unites all particles into one space. Mathematician and physicist Ron Kurtus states that

"An analogy of gravitational and electromagnetic fields is seen by comparing the Einstein Field Equations from the General Theory of Relativity with Maxwell's Field Equations for electrical and magnetic fields." (11)

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". (12)

Extending the ideas of “doubling”, “two-valued” and “hidden rotation” to the Mobius strip being a basic, fundamental unit of reality**;** it can be seen that Pauli’s proposal has an analogy to this article. The doubled Mobius strips produced by the two-valued binary-digit system creates the figure-8 Klein bottle (plus its hidden, now identified as Wick, rotation).

This proposed link between the Mobius strip and the Mobius doublet (figure-8 Klein bottle) would also be a link between the photon and graviton, suggesting unification of electromagnetism with gravitation.

Recalling how photons can be at rest in an electromagnetic wave, it's possible for electrons to be at rest in a superconductor. 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. (13) John Bardeen commented - "The idea of paired electrons, though not fully accurate, captures the sense of it." (14) His comment about the idea of paired electrons not being fully accurate can mean that superconductivity is, at least partly, a wave motion not involving the motion of particles.

The inner and outer surfaces of a Mobius form a continuous strip in space – unification of space with time requires a temporal continuity. This is carried out by Wick rotation's continuous cycling between what are called real and imaginary time – a property programmed into the Mobius strip. Therefore, the Mobius strip combined with Wick rotation and imaginary time (represented as the vertical direction on mathematics’ Complex Number Plane) provides a modern way to unite space and time into one space-time. **Since time and space are forever united, imaginary time must be joined with an imaginary space and imaginary space-time would be the realm of Dark Matter.** (The continuously curved Mobius surface + continuous Wick rotation = curvature of space-time.) Like ocean waves diverted towards the mass of an island, the primary focus of mass-contributing gravitational waves must be a galaxy's centre because they help form a supermassive black hole there.

NEUTRONS AND HIGHER 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 midnineteenth 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 6 – 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." (15)

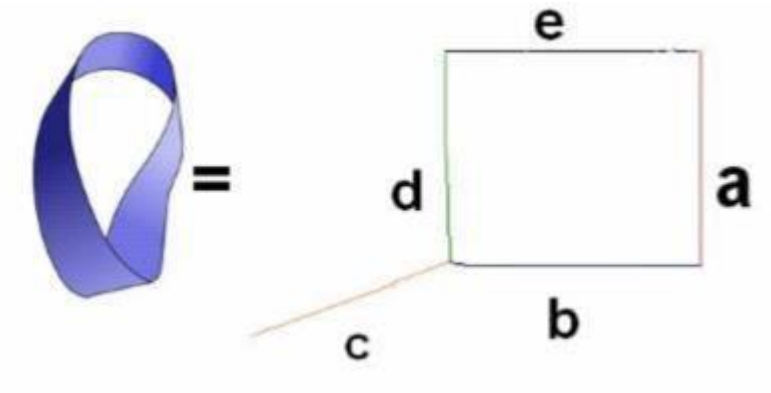


Figure 7 – MOBIUS MATRIX (Mobius equals a,b,c,d,e array)

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 (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, existing in the particles of matter composing side a. In other words, matter's most fundamental composition is mathematics' topological Mobius, which can be depicted in 3-dimensional space by binary digits creating a computer image). The twist needs to be exaggerated, with the upper right of the Mobius descending parallel to side "a" then turning perpendicular to it at approximately the level of the = sign, then resuming being parallel. 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.

(1) The matrix mathematics/matrix mechanics of 90+90 equalling either 180 or 90 can also be related to the fact that a neutron bound in an atom's nucleus can be stable but a free neutron is unstable - decaying to a proton, electron and antineutrino with an average lifetime of just under 15 minutes. 90+90=180 possesses a change to the numerals and is likened to instability while 90+90=90 has no change and has analogy to stability. Why aren't protons or electrons (for example) affected? Since protons bound in a nucleus

can be stable or unstable (protons can transform into neutrons which can change into protons since neutrons can be unstable), the matrix maths/mechanics must be affecting them – the influence on neutrons may be more apparent since these particles decay into protons and electrons. Neutrons bind with protons and one another in the nucleus via what is called the strong nuclear force, effectively moderating the repulsive forces between the protons and stabilizing the nucleus (radioactive decay proceeds via what's called the weak nuclear force so as to change the neutron/proton ratio to increase stability). This binding via the nuclear force can be regarded as an attractive force coming from the neutrons. Neutron formation, like formation of every particle, depends on gravitation interacting with electromagnetism (see Footnote 2). Therefore, it'd be correct to view the nuclear forces as non-fundamental and a product of gravitational force, just as the tides in Earth's oceans may be viewed as increased or reduced suppression of water waves by gravitational waves (Footnote 3).

(2) The matrix mathematics/matrix mechanics of 90+90 equalling either 180 or 90 can also be related to the fact that the most abundant form of iron (atomic mass unit = 56, comprises 92% of natural iron) is the most stable element, while there are unstable and radioactive isotopes with half-lives varying from nanoseconds to 2.6 million years. This might be able to be applied to the question's fusion of hydrogen into uranium. When fusion reaches the most stable element, it might be made to bypass that stability and continue all the way to uranium. How? By using that higher dimension - which might possibly be the origin of dark matter and dark energy^ - and manipulating the Mobius strip (space-time's topology). The manipulation might change the stability of iron's 90+90=90 into the instability of 90+90=180, and that instability should allow fusion to continue far beyond the cobalt and nickel that decay to iron.

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’. (16) Retarded gravitational and electromagnetic waves that go forwards in the horizontal plane of space-time can be termed real. Advanced waves that go backwards in spacetime may be considered complex. The imaginary numbers of the vertical direction could describe waves in an "imaginary" space-time.

On the subject of dimensions of space-time**:** 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'. (17)

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 (quantum gravity is the anticipated unification of quantum mechanics with Einstein's theory of gravity – General Relativity).

We see that the Mobius is necessary to the immaterial portions of the world – not only undetected large-scale dimensions but also particles of energy (the photon of electromagnetism would be an assembly of trillions of strips). Now cast your mind back to **BITS AND TOPOLOGY**. When introducing this section, the subject of quantum spin was first mentioned. Appropriately, it will be mentioned again now regarding the structure of gravitation's graviton (by copying a paragraph from **SUPERSYMMETRY 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".

Extending the ideas of "doubling", "two-valued" and "hidden rotation" to the Mobius strip being a basic, fundamental unit of reality**;** it can be seen that Pauli's proposal has an analogy to this article. The doubled Mobius strips produced by the two-valued binary-digit system creates the figure-8 Klein bottle (plus its hidden, now identified as Wick, rotation). This not only unites the Mobius strip with the figure-8 Klein bottle but also the photon with the graviton ie electromagnetism with gravitation. It also confirms Erik Verlinde's idea that gravity is an emergent property (emerging from mathematics).

BONUS SECTION – HOW COULD GRAVITY EMERGE FROM MATHEMATICS?

(SUBTITLED - ANALOGY OF QUANTUM SPIN AND MATRIX ARRAY WITH ELECTROMAGNETIC AND GRAVITATIONAL WAVES PRODUCED FROM PURE MATHEMATICS)

Abstract -

This bonus section was inspired by the astronomy/astrophysics course "Greatest

Unsolved Mysteries of the Universe". It was prepared by ANU (the Australian National University), was put on the Internet by edX, and the two presenters in the course's videos are Dr. Paul Francis and Brian Schmidt (yes, the co-winner of the 2011 Nobel Prize for Physics himself).

In the video "V5.8**:** 21 centimetre radiation and the first stars", Brian said

"(To get emission from the hydrogen atom) we're going to have to resort to a little trick of quantum mechanics that is provided for the hydrogen atom, which is that the proton and electron within quantum mechanics have a spin. It's analogous to a top spinning. It turns out that the hydrogen atom has a different energy if those spins are in opposite directions. It turns out it actually has a lower energy and so you can have an energy transition when that flip occurs and a photon comes out."

Then Paul said,

"It's a bit like having two bar magnets. If you have them with north pole to north pole, or north pole to south pole, you'll feel a different amount of force between them; a different energy between these two things. When these things are spinning the same way or the opposite way there's a little tiny energy difference between them."

The following explains analogy of quantum spin to maths' matrix and how, using that analogy, the statements by Brian and Paul can be converted into a mathematical origin of electromagnetism and gravitation.

Bonus section -

These five scientists support the idea of the universe being composed of information/mathematics:

a) The digital physics pioneered by Professor Edward Fredkin believes that biology reduces to chemistry reduces to physics reduces to the computation of information. (Edward Fredkin, 'Digital Philosophy',

b) 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. (John A. Wheeler, 'Information, physics, quantum: The search for links', in Zurek, Wojciech Hubert, *Complexity, Entropy, and the Physics of Information (*Redwood City, California: Addison-Wesley 1990))

c) 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. (E. P. Verlinde, 'Emergent Gravity and the Dark Universe', (2016))

d) Cosmologist Max Tegmark hypothesizes that mathematical formulas create reality. (Max Tegmark, *Our Mathematical Universe (*Random House/Knopf, 2014))

e) '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.' (Zeeya Merali, 'Theoretical physics: The origins of space and time', *Nature* 500 (2013), 516–519)

The following explains how the statements by Brian and Paul can be converted into a mathematical origin of electromagnetism and gravitation.

First, let's look at the statement "... particles within quantum mechanics have a spin. It's analogous to a top spinning." The 2008 book "Quantum" by physicist and philosopher Manjit Kumar (Icon Books, pp. 382-383) says,

"**Quantum spin** is a fundamental property of particles with no direct counterpart in *classical physics*. Any picturesque comparison of a 'spinning' *electron* to a spinning top is merely a poor aid that fails to capture the essence of this *quantum* concept. 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 a whole number or half a whole number multiplied by *Planck's constant* h divided by 2π (a quantity called h-bar). Quantum spin is said to be either up (clockwise) or down (anti-clockwise) with respect to the direction of measurement."

I imagine the early part of this ANU course only needs a "picturesque comparison" - nevertheless, that might be enough to demonstrate that we live in a universe composed of maths. **My idea is that quantum spin may actually be analogous 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. Matrix multiplication says X multiplied by Y does not always equal Y times X.

Suppose we think of the matrix array as composed of two bar magnets, with the bar magnets being composed of photons and gravitons instead of atoms (the energy and momentum of the photons and gravitons exert a pressure which we call mass when it's in particles or atoms). As Paul Camp, Ph.D. in theoretical physics, writes at "A photon is a quantum of excitation of the electromagnetic field. That field fills all space and so do its quantum modes."

(Since matter exists in space, let's assume for the moment that the electromagnetic field and its photons also fill all matter - we can abandon this hypothesis later if it fails). Why photons AND gravitons? Mathematician and physicist Ron Kurtus writes at (5 December 2010) - "An analogy of gravitational and electromagnetic fields is seen by comparing the Einstein Field Equations from the General Theory of Relativity with Maxwell's Field Equations for electrical and magnetic fields."

Now let's return to "Matrix multiplication says X multiplied by Y does not always equal Y times X" and "the matrix array (being) composed of two bar magnets". XY can represent magnetic North on one bar attracting magnetic South on the other. YX can represent South repelling South. When different magnetic poles (or different combinations of the two letters) are close together, you'll feel a different force between them - there's a little tiny energy difference between them. Picture the bar magnets as coming together at an angle - not in a straight line. When quantum spin changes from XY's attraction to YX's repulsion, nano-nano-nano sized bits of the magnets (the photons and gravitons composing them) are repelled or emitted, accounting for electromagnetic and gravitational waves from the magnets. In reality, the magnets are merely a substitute for the matrix array which appears to truly be analogous to quantum spin and also appears to provide a purely mathematical origin for electromagnetic and gravitational waves.

"What the spin of a particle really tells us is what the particle looks like from different directions." (18)

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. A Higgs boson looks like a dot: the same from every direction.

Spin ½ is like a Mobius strip. A particle of matter has to be turned through two complete revolutions to look the same, and you must travel around a Mobius strip twice to reach the starting point.

Two adjoining sides of a parallelogram (see Fig. 8) represent the vectors of the photon's spin 1 and the graviton's spin 2. The resultant diagonal represents the interaction of the sides/vectors (1÷2 = the spin ½ of every matter particle). Tensor calculus changes the coordinates of the sides and diagonal into the coordinates of a position on a line (a single point on the diagonal). This scalar point is associated with particles of spin 0. If the mass produced during the 1÷2 interaction happens to be 125 GeV/c^2, its union with spin 0 produces the Higgs boson. 125 GeV/c^2 united with spin 0 means the central scalar point of the Higgs boson is related to the vector of the graviton's spin 2, and the Higgs field is therefore united with the supposedly unrelated gravitational field (together with the latter's constant interaction with the electromagnetic field).

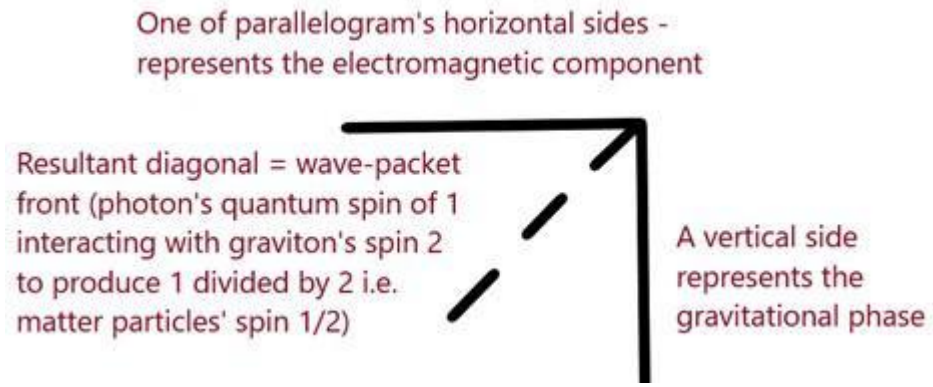


FIGURE 8: WAVE-PACKET FRONT AS QUANTUM SPIN

It must be remembered that referring to space alone is incomplete. Living in space-time, it's necessary to add some sentences about the time factor. The photon must interact with the graviton to produce the mass of the mass of the weak nuclear force's W and Z bosons. To produce their quantum spin, the photon's spin 1 needs to react with the graviton's spin 2. That is, the photon's turning through one complete revolution needs to be combined with the graviton's being turned through two half-revolutions.^ Incorporating the time factor as a reversal of time in the middle of the interaction: a gravitonic half revolution is subtracted from the photonic full revolution then the graviton's time-reversal adds a half revolution (1-½+½ = the spin 1 of W and Z bosons). The strong nuclear force's gluon's quantum spin of 1 could arise in the same way as the spin 1 of weak-force bosons.

How, then, can repelling or pushing gravity account for the apparent attraction of ocean tides towards the Moon? I believe such an idea of gravity requires the idea of 17th-century scientists Isaac Newton and Johannes Kepler that the moon causes the tides, to be joined with Galileo's idea that the Earth's movements slosh its water.

"If a barge (carrying a cargo of freshwater) suddenly ground to a halt on a sandbar, for instance, the water pushed up towards the bow then bounced back toward the stern, doing this several times with ever decreasing agitation until it returned to a level state. Galileo realized that the Earth's dual motion—its daily one around its axis and its annual one around the sun—might have the same effect on oceans and other great bodies of water as the barge had on its freshwater cargo." (19)

Gravity's apparent attraction can be summarized by the following - gravitation is absorbed into wave packets and the inertia of the gravitons (united with far more energetic photons) carries objects towards Earth's centre at 9.8 m/s or 32 ft/s. The volume of the oceans on Earth is estimated at nearly 1.5 billion cubic kilometres. (20) All this water is being pushed towards Earth's centre at 32 feet per second every second. But the seafloor prevents its descent. So there is a recoil, noticeable offshore (it is only where oceans and continents meet that tides are great enough to be noticed). This recoil is larger during the spring tides seen at full and new moon because sun, Earth and moon are aligned at these times.

The previous paragraph's alignment of Sun, Earth and moon refers to their being lined up where the gravitational current is greatest (in the plane where planets and moons are created) - and to more of the gravitational waves travelling from the outer solar system being captured by solar and lunar wave packets, and less of them being available on Earth to suppress oceanic recoil (there are still enough to maintain the falling-bodies rate of 32 feet per second per second). At the neap tides of 1st and 3rd quarter; the sun, earth and moon aren't lined up but form a right angle and our planet has access to more gravity waves, which suppress oceanic recoil to a greater degree. We can imagine the sun and moon pulling earth's water in different directions at neap tide but suppression is a more accurate description. If variables like wind/atmospheric pressure/storms are deleted, this greater suppression causes neap tides which are much lower than spring tides.

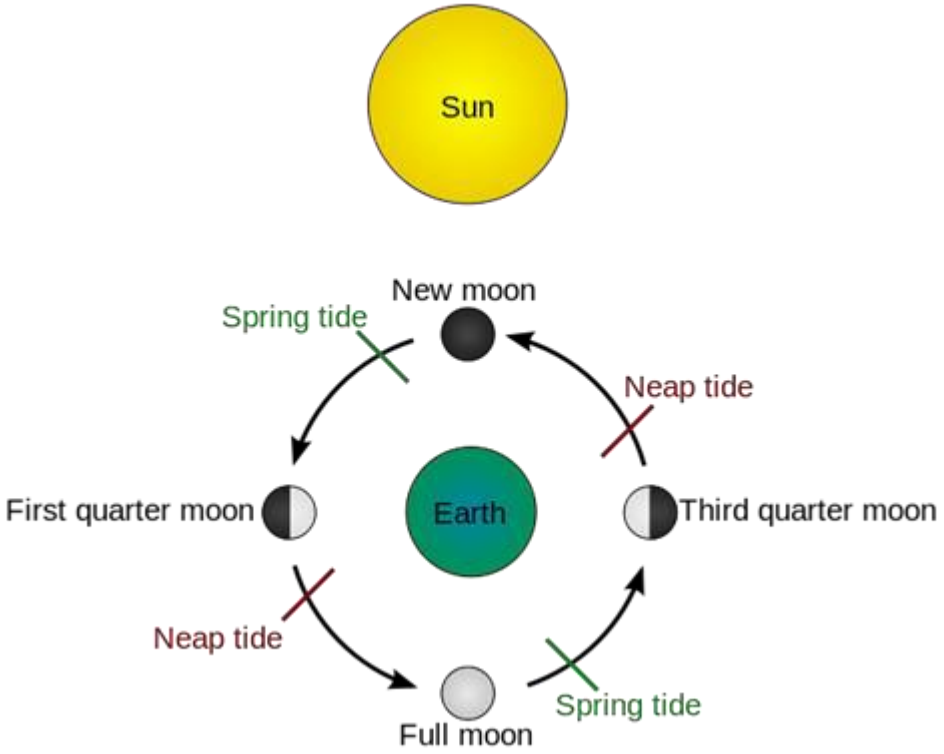


Figure 9 – TIDE SCHEMATIC

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Let's apply this aspect of gravity to a few other instances -

M-SIGMA

The M-sigma relationship was only discovered in 2000 and is observational, meaning scientists noticed it first and are now trying to understand the cause. M refers to the mass of a galaxy's central black hole, and sigma stands for the speed at which stars fly about in the galaxy's bulge. The bigger the black hole, the faster the stars move - the greater is their velocity dispersion. (21)

Gravitational waves would explain the cause. Some of the ocean waves passing an island are refracted - when they enter shallow water, they're refracted by friction with the mass of the seabed. They change direction and head towards the island, breaking onto

its beaches. Similarly, gravitational waves are refracted and focus on the centre of a mass. In this case, the mass the waves are headed toward is the black hole, where they help form its composition.

General Relativity proposes that the space-time composing the cosmos IS gravitation. Gravitational waves not only compose space-time but also so-called "imaginary" spacetime (which exists on the Complex Number Plane's y-axis, can interact with our dimension on the x-axis, and is the possible domain of what are called dark matter and dark energy). The linear motion of waves headed towards the central black hole and striking stars' sides during the journey is converted into increased (and perpendicular) orbital speed of the stars since the gravitational waves of imaginary time are at 90 degrees to the gravitational waves of space-time (recall how we can picture imaginary time as another kind of time in the vertical direction when familiar time is a horizontal line).

GEYSERS ON SATURN'S MOON ENCELADUS

"A small water jet on Enceladus, an icy moon of Saturn, spews its fiercest eruptions when the moon is farthest from the planet, a new study suggests, but the overall gas output doesn't increase much during that time. The study points to a mystery in Enceladus' plumbing." (22)

Basically, the problem seems to be that humans haven't caught up with Einstein's ideas about gravity yet. In 1919, he submitted a paper to the Prussian Academy of Sciences asking "Do gravitational fields play an essential role in the structure of elementary particles?" (23) If so, gravitational waves from deep space would focus on the centre of a planet's mass. When Enceladus is near Saturn, it would also be close to increased activity of the waves. The increased push from them would suppress emission of dust-sized water-ice grains, which is 3 times greater at the moon's farthest point because suppression is reduced there. Gas emission is also increased. Since this is not 3 times more, but only 20% more, a plumbing problem would be causing the discrepancy.

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