**MATHEMATICAL NATURE OF GRAVITY, WHICH GENERAL RELATIVITY SAYS *IS* SPACE-TIME: Topology Unites With the Matrix, E=mc2, Advanced Waves, Wick Rotation, Dark Matter & Higher Dimensions**

By Rodney Bartlett#

# studied sciences with Charles Darwin University, Australia (not presently affiliated) Stanthorpe, Australia

corresponding author: Rodney Bartlett, rodney.bartlett22@yahoo.com

Abstract -

General Relativity says gravity is a push caused by space-time's curvature. Combining General Relativity with E=mc2 results in distances being totally deleted from space-time/gravity by future technology, and in expansion or contraction of the universe as a whole being eliminated. The road to these conclusions has branches shining light on supersymmetry and superconductivity. This push of gravitational waves may be directed from intergalactic space towards galaxy centres, helping to hold galaxies together and also creating supermassive black holes. Together with the waves' possible production of "dark" matter in higher dimensions, there's ample reason to believe knowledge of gravitational waves has barely begun. Advanced waves are usually discarded by scientists because they're thought to violate the causality principle. Just as advanced waves are usually discarded, very few physicists or mathematicians will venture to ascribe a physical meaning to Wick rotation and "imaginary" time. Here, that maths (when joined with Mobius-strip and Klein-bottle topology) unifies space and time into one space-time, and allows construction of what may be called "imaginary computers".

This research idea you're reading is not intended to be a formal theory presenting scientific jargon and mathematical formalism.

Keywords

Cosmology of Theories beyond the SM; Models of Quantum Gravity; Topological States of Matter; M(atrix) Theories

Article -

**ADVANCED WAVES, BITS AND COSMIC TOPOLOGY**

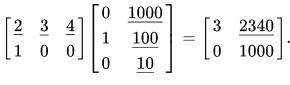
Consider the Wheeler-Feynman absorber theory(1) and Transactional Interpretation of Quantum mechanics.(2) These speak of "retarded" electromagnetic waves going forward in time and "advanced" waves going backwards in time. Einstein's gravitational equations contain enough information about electromagnetism to allow electromagnetism equations to be restated in terms of these gravitational fields,(3) giving gravity retarded and advanced components too.

"When we solve (19th-century Scottish physicist James Clerk) Maxwell's equations for light, we find not one but two solutions: a 'retarded' wave, which represents the standard motion of light from one point to another; but also an 'advanced' wave, where the light beam goes backward in time. Engineers have simply dismissed the advanced wave as a mathematical curiosity since the retarded waves so accurately predicted the behavior of radio, microwaves, TV, radar, and X-rays. But for physicists, the advanced wave has been a nagging problem for the past century." ^ (4)

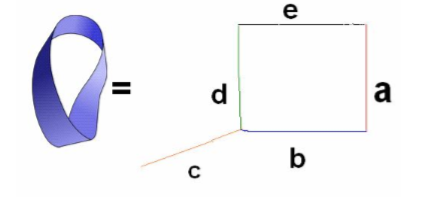
^ Advanced waves are usually discarded because they are thought to violate the causality principle: advanced waves could be detected before their emission. On one level, I can appreciate that reasoning. But ultimately, I think it's an error that should be replaced by Isaac Newton's idea of gravity and the modern idea of quantum mechanics' entanglement. 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.

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=√(-1)* are on the vertical plane. ‘Complex Numbers’ can be easily identified as a combination of ‘Real Numbers’ and ‘Imaginary Numbers’.(5) 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 space-time may be considered complex. The imaginary numbers of the vertical direction could describe waves in an "imaginary" 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'. (6) 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).



**Figure 1 – MATRIX MULTIPLICATION** - *From <*[*https://en.wikipedia.org/wiki/Matrix\_(mathematics)*](https://en.wikipedia.org/wiki/Matrix_(mathematics))*> This Wikipedia diagram is not used to support a scientific claim, but merely as an example of what basic matrix multiplication looks like.* The matrix, a rectangular array of numbers or symbols placed in rows and columns has a long history possibly going back 3,000 years to its 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.



**Figure 2 – MOBIUS MATRIX (Mobius equals a,b,c,d,e array)** - Width d has to be at right angles to lengths b & e, the other width of a, & height c 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). This is accomplished by a twist, like on the right side of the Mobius strip pictured above. 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 has similarities to the Matrix of mathematics. The first 90 plus the second 90 does not always equal the second 90 plus the first 90). The conclusion is that the Mobius strip is a basic, fundamental unit of physical reality. The conclusion will be elaborated on below in the part regarding base-2 maths (binary digits), the Mobius strip and the figure-8 Klein bottle. Referring to the later subheading **SUPERSYMMETRY AND WICK ROTATION**, the basic nature of the Mobius applies to both the boson particles of gravitation and the fermion particles of physicality's matter in known space-time/so-called "dark" matter in higher-dimensional "imaginary" spacetime.

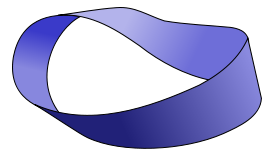
Stephen Hawking writes, "What the spin of a particle really tells us is what the particle looks like from different directions."(7)

Particles of matter like the proton and electron have spin 1/2, which means these particles must be turned through 2 complete revolutions to look the same – and, not coincidentally, you must go round a Mobius strip twice to reach your starting point. It seems plausible that the particular values of quantum spin could be determined by another set of particular values viz those in electronics' BITS or BInary digiTS, which always take the form of either 1 or 0. 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.(8)

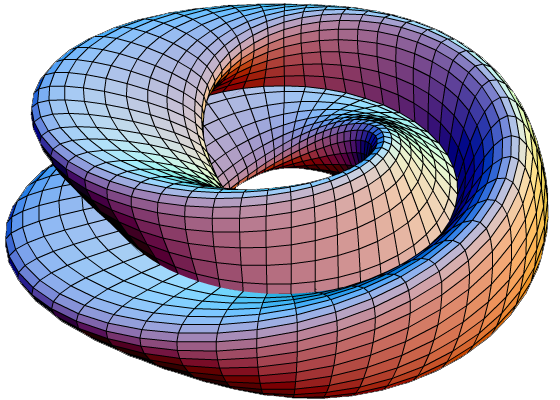
(I believe "holographic" could refer to the interference between gravitational and electromagnetic waves [see next paragraph], while "2D packages trillions of times smaller than an atom" could refer to Mobius strips. In this way - just as the interference between two laser beams produces a three-dimensional holographic image, "holographic" would also have the accepted cosmological meaning of the entire universe being seen as two-dimensional information projected into three dimensions.)

**Figure 3: MOBIUS STRIP** (source: <http://www.clker.com/cliparts/3/7/a/9/1220546534781713951lummie_Mobius_Strip.svg.hi.png>)



Then two strips must be joined to make a 4-D Klein bottle(9) which has length, width, depth and 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(10). 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(11). An implication of a 1919 paper by Einstein is that the coupling is between gravitons and photons.(12). With trillions of Mobius and figure-8 Klein elements assembled, an appropriate number of photons and gravitons must be included to give the matter what we call mass. (Subatomic particles must possess quantum mechanical wave-particle 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 – and duality is necessary for matter to be included in spacetime unification.)

**Figure 4: 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=mc2, 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 space-time). 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=mc2 only applies to motionless photons). 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 mass-producing 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 (it's the disturbances - shock waves - of fluctuating amplitudes and frequencies that travel). The above ideas of gravitational and electromagnetic waves displaying no relocation 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. (13)

**WAVE-PARTICLE DUALITY AND E=mc2**

To give some more detail about why there's no cosmic expansion -

Wave-particle duality can be described by starting with *v=fλ* (wave velocity, m/s). Velocity of particles like a car 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. (14) Gravitational and electromagnetic wave motion (space-time motion) travels at c, the speed of light ie

v= fλ = distance/duration = space/time = c (equation 1)

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 (equation 2)

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 (equation 3)

What about the "squared" in E=mc2? In later papers Einstein repetitively stressed that his mass-energy equation is strictly limited to observers co-moving with the object under study.

In order for E=mc2 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? Present-day observers can never move at the speed which light is reported to cover 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.

'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.' (15)

Though the effect is measured for distances in space, the inseparability of space and time means that moments of time can become entangled too. (16)

The link between the quantum and macroscopic worlds means the transverse wave motion of electromagnetic waves is identical to the transverse wave motion in a body 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. Like waves of water, electromagnetic waves are 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.

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."(17)

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. The speed of light - or according to this article, coverage of excitations - 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. (18)

Since Einstein's mass-energy equation is strictly limited to observers co-moving with the light beam under study, "squared" must be added to the mass/light-speed part of this article's equation -

E = v = fλ = distance/duration = space/time = mc2  (equation 4)

Simplified by removal of the middle elements, this becomes E=mc2

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

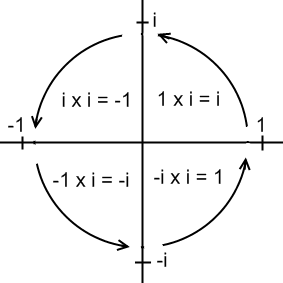
To sum up, photons can be at rest in an electromagnetic wave (it's the shock waves or fluctuating amplitudes and frequencies that travel). Since E=mc2 only applies to the photon when it's at rest, the equation does indeed apply to the cosmos – and consequently, so do E=0 and m=c2 which negate distance in space-time as well as stating the universe cannot be expanding or contracting.

What about the Cosmic Microwave Background that supposedly proves the Big Bang theory? Or what about the astronomical redshift that supposedly means the universe is expanding? The answer to the microwave objection can be summed up in one 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)."

To answer the redshift problem almost as briefly - 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 General Relativity says gravity is just another term for the curvature of space-time, the gravitational field out of which proceeds a particular measurement of electromagnetic 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.

**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 space-time.



**Figure 5 – 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."(19)

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 both fermions and bosons - and therefore unites all particles (of matter and of energy) into one **space**. 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. (20) John Bardeen commented - "The idea of paired electrons, though not fully accurate, captures the sense of it." (21) 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 provides a modern way to unite space and time (and imaginary space-time's dark matter) into one **space-time**. (The continuously curved Mobius surface + continuous Wick rotation = curvature of space-time.) This revised supersymmetry says gravitons (the most basic parts of gravity and gravitational waves) are cycling or oscillating between real, poorly named imaginary, and complex time. So the waves themselves must be cycling too - between the retarded, imaginary and advanced states. Like ocean waves diverted towards the mass of an island, the primary focus of mass-contributing gravitational waves (only the retarded state would be detected by instruments such as LIGO, the Laser Interferometer Gravitational-wave Observatory) must be a galaxy's centre because they help form a supermassive black hole there (electromagnetism would be the other contributor of mass, according to Einstein's 1919 paper).

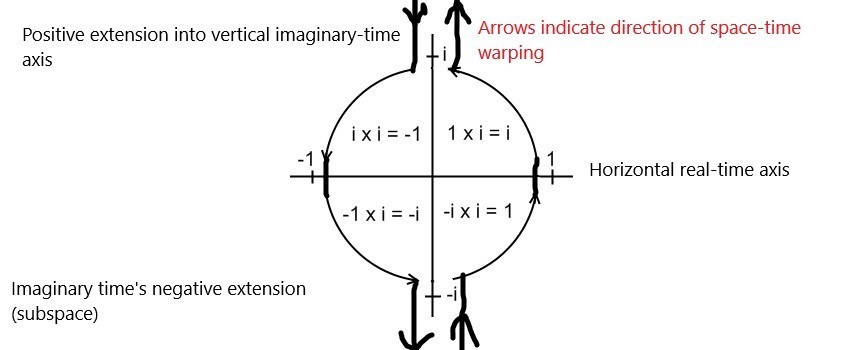
^ In a science TV program, (22) Dr. Graham Phillips reported that "the physicist and writer Paul Davies thinks the universe is indeed fine-tuned for minds like ours. And who fine-tuned it? Not God but minds from the future, perhaps even our distant descendants, that have reached back through time ... 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."

**APPLIED WICK ROTATION AS "IMAGINARY" COMPUTERS**

Our present approach to developing computers has gone about as far it can. The problems of chips generating too much heat - and of quantum uncertainties making transistors hopelessly unreliable at the scale of atoms - demand a new approach. I'm proposing that the successor to today's silicon technology (and tomorrow's quantum computers) lies in new concepts of time. An "imaginary" computer using the Complex Number Plane's vertical axis of imaginary time can perform calculations at the familiar rate of time's passing while the horizontal axis of "real" time sees absolutely no elapsed time (the possibility of no time passing in the normal sense is hinted at by Special Relativity's time dilation or slowing of time).

The imaginary computer (IC) is, naturally, in horizontal real-time. However, its processing is warped into vertical imaginary-time (IT). The IT extensions could potentially go on for great distances. So the IC could perform voluminous processing without any ordinary, real time passing at all. Periodically, the output of the processing is looped back to the computer on the horizontal plane. Using this technique, even one of today's digital machines could produce fantastic, unbelievable results in virtually no time. These warps and loops are viable because they're inspired by Einstein's Special Relativity – and they propose the use of space-time warping which, though in its infancy, is a technology being worked on today by places like NASA.

**Figure 6 - APPLIED WICK ROTATION AS "IMAGINARY" COMPUTER**



**FOOTNOTES**

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