Hypothesis

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Posted Date: 22 May 2025

doi: 10.20944/preprints202505.1698.v1

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 doi:10.20944/preprints202505.1698.v1



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# Gravity, Topology, and Complex Mathematics in the Universal Optimized Simulation

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**Abstract:** This article appears to have started when a MicroSoftNetwork article called *"Optimizing Mechanism": Physicist Claims Gravity Is Evidence We May Be In A Simulation* was read. Appearances really are deceptive, however. Thoughts it contains can be traced back a few decades to musings about the Mobius strip. These thoughts took a more serious turn in 2005 when my book on Amazon ("ROD'S ROOM - A New Earth and A New Universe") combined ideas about science with a few poems and some short stories. Ideas gradually advanced over the next decade, becoming more frequent and detailed in 2018 when something I called *vector-tensor-scalar geometry* popped into my head. Hypotheses regarding science and mathematics have been accelerating ever since. I've never felt that the source of these ideas was the reasoning in my brain. It always felt like I was a student learning things that were already common knowledge, even though the thoughts were obviously strangers to anyone living. I often find that ideas which found their way into my head in the past were made clearer by ideas that came later. For example, the geometry mentioned a few sentences ago found application years later to consciousness, topological insulators, and cosmology's holographic principle. This latest article seeks to combine many ideas - and to explain them better than in the past. So much for personal history and self-indulgence … what are some of the scientific topics in this article? Computational or simulated universe, holographic principle, gravity, topology, real and imaginary numbers, quantum mechanics, quantum spin, mass, Higgs boson and field, gluon, Wick rotation, Riemann hypothesis, retarded and advanced waves, time, vector-tensor-scalar (VTS) geometry, elliptical VTS geometry, consciousness, single-particle universe, bosons + fermions.

**Keywords:** computational or simulated universe; holographic principle; gravity; topology; real and imaginary numbers; quantum mechanics; quantum spin; mass; Higgs boson and field; gluon; Wick rotation; Riemann hypothesis; retarded and advanced waves; time; vector-tensor-scalar (VTS) geometry; elliptical VTS geometry; consciousness; single-particle universe; bosons + fermions

## 1. Article

An interesting sentence in an MSN article about Dr. Vopson's theories concerning a computational or simulated universe is - "Essentially, moving several objects close together via gravity reduces the amount of computational power to describe the whole system." [1]

The centres of the gravitons, whether the gravitons are pictured as particles or waveforms, might be physically quantum entangled. Then all the universe's gravitational fields could be regarded as a single graviton. In this way, objects couldn't possibly be closer and computational power would be at its absolute minimum. How could this kind of entanglement be achieved? A form of entanglement - not limited to laboratories and temperatures near absolute zero (or in stars' cores) - might be achieved by adaptation of cosmology's holographic principle. [2] The principle says the 3rd dimension results from information in a 2nd dimension. By reprogramming that 2nd dimension, the 3rd dimension (and thus, distance) is feasibly totally removed between the centres of particles, physically quantum-entangling them.

Accepting the computational nature of the cosmos, imagine that the 2nd dimension is the 2D Mobius strip being composed of electronics' binary digits. Trillions of strips could compose a photon, with a pair of Mobius strips joining into the 3rd dimensional figure-8 Klein bottle [3] (trillions of these

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Klein bottles make up a graviton). This is another way of saying the 3rd dimension results from information in a 2nd dimension. Interaction of photons and gravitons might cause a pressure defined as mass of, say, the nuclear-force particles. And the photon's quantum spin of 1 could be divided by the graviton's spin 2 to produce any fermion's spin ½. Such a scenario agrees with a paper of Einstein's which asks if the interaction of gravitation and electromagnetism plays a role in forming elementary particles. [4]

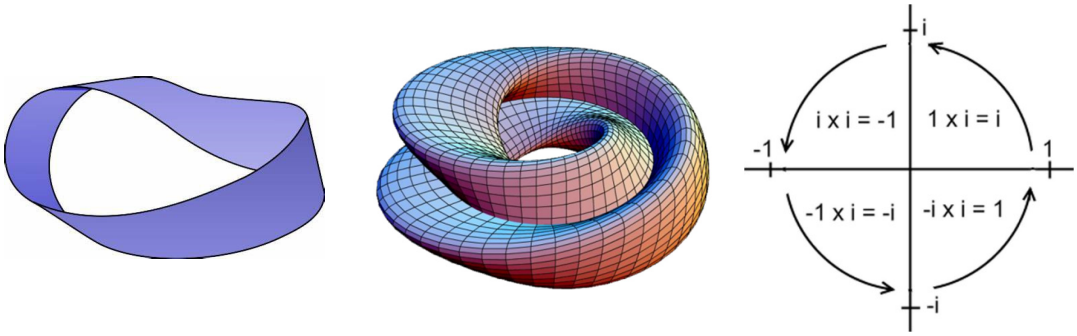


**Figure 1. - (left to right) Mobius Strip, figure-8 Klein bottle, Wick Rotation** (source - Google search of public-domain images).

The strong nuclear force's massless gluon could be formed by cancellation. Wick Rotation can exemplify cancellation of the Real and Imaginary components within the universe's Complex mathematics if Wick isn't restricted to being thought of as mere convenience or trickery. Wick is a circle containing two axes that intersect at its origin - a horizontal x-axis whose "real" ends are labelled 1 and -1, plus a vertical y-axis with "imaginary" ends *i* and *-i*. Whenever a point on this complex plane is multiplied by *i*, it moves a quarter rotation around the origin or center of the plane (counterclockwise). Start with 1, multiply by *i* then by *i* again *($i^2 = -1$)*, then add the 1 and -1 to get 0 (cancellation of gluon mass). The above paragraph illustrates motion from right to left in the upper half-plane. Movement from left to right in the lower half-plane must also exist ie**:** $-1 \times i^2 = 1$. In physical terms, this bidirectional motion can be expressed as a wave moving in two directions. This article is discussing binary digits as well as the topological Mobius and Klein as the basic composition of subatomic particles. The discussion is therefore related to quantum mechanics. Imaginary numbers are essential in quantum mechanics. So a possibility worth considering is that Wick rotation, with its inclusion of imaginary numbers, is built into the Mobius strip (and into the Klein bottle, which is a union of a pair of strips). The electric pulses and binary digits of computation embrace the first dimension with the 2nd and 3rd being addressed by the Mobius and Klein plus their formation of photons and gravitons which interact to produce bosons and fermions. Could the 4th dimension of time be represented by Wick rotation whose real and imaginary numbers act as a timepiece, displaying and recording the movement of particles? The two directions waves move in would then not be in space but would reside in time - one could travel forwards in time, the other back in time.

Both gravitational and electromagnetic waves may theoretically possess retarded and advanced * components which travel forwards and backwards in time, cancelling one another and entangling all masses. Wick rotation (time) is built into the Mobius strips and figure-8 Klein bottles composing electromagnetism's photons and gravitation's gravitons. Therefore, all time (the entire past and present and future) is united into one thing just as all space and all mass are entangled into one thing. If time only passed rectilinearly - from past to present to future - the idea of waves travelling back in time would make no sense at all. But if time is curvilinear - with past, present, and future interconnected - time must be able to move from future to present to past. (General Relativity says space, and time, are curved. ** ) Unity of past/present/future may remove the issue of non-simultaneity – in special relativity – because the timing or sequence of events being different in different frames of reference can only exist if past/present/future are separate. The concepts of cause and effect are no longer separate when all

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periods of time are united, and everything can happen "at once". Remembering that the previous paragraph suggested Wick rotation is built into reality and can act as a recording, this is similar to watching a DVD – every event on the DVD exists at once since the whole DVD exists but we're only aware of sights and sounds occurring in each tiny fraction of a second.

* "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 lightbeam goes backward in time." [5]

*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. [6] It's therefore likely that gravitational waves also possess retarded and advanced portions. Advanced waves travel back in time and when combined with the retarded waves which go forwards in time, their entanglement would result in an "eternal present" necessary for time travel. ****

John G. Cramer wrote in his 2022 Internet article "Advanced Waves Detected" - "In summary, it appears that advanced waves do exist and have been detected. Much more work must be done to ensure that this effect is real and can be extended, but the physics implications are gigantic." [7]

** Time's curvature might be described by space-time being warped to follow the circular diagram of Wick rotation. Space may be thought of not as a curved fabric or curved rubber sheet but, as this paragraph proposes, as gravitons and photons travelling on curved paths. Some well known scientists – John Wheeler, Erik Verlinde, Max Tegmark, Edward Fredkin, Melvin Vopson - suggest that information is fundamental to the physics of the universe, and that computer-generated / mathematical formulas create reality. In the case of waves being digital, the waves would not merely be described by mathematics but would literally be the result of maths. A 3D (three dimensional) cube can be regarded as a reality coded on a 2D surface - in other words, the cube is a projection from a square. The 2D square would be a nonlinear (angular) math object resulting from adding four lines, each one being separated from those adjoining it by 90 degrees. The cubic shape would result from adding, in one direction, multiple layers of the information in the square. Instead of programming a set of points to follow a straight line, they can be represented curvilinearly as a waveform and described by Fourier analysis, etc. Interacting particles can produce waves just as masses can curve spacetime to produce gravity and gravitational waves. VTS Geometry (see final section) plausibly explains the inverse - it doesn't solely regard gravity as the result of mass but also regards gravity, partnering with electromagnetism, as producer of mass. Inverting quantum mechanics, gravitational and electromagnetic waves create particles with mass (protons, neutrons, quarks, electrons, etc - even the Higgs boson). Ultimate reality does not have to be described in terms of matter (with elementary particles such as quarks) though it certainly can be. In this paragraph, the idea of curved space is described by gravitons and photons travelling on curved trajectories.

*** The Riemann hypothesis is concerned with "nontrivial zeros" on the "critical line", stating that these zeros lie on the vertical axis of the Complex Plane i.e. on the y-axis in then-undiscovered Wick rotation which may be related to time (and to space, since the two aren't separate and we live in space-time). Since the critical line links Wick rotation to the Riemann hypothesis, spacetime may be describable by Riemann. The critical line pertains to zeros. So the distances in space-time that could be described by the Riemann hypothesis might, after spacetime has been warped according to the quantum entanglement derived from the holographic principle, equal zero. This would make time travel to both the past and future possible as well as making instant intergalactic travel feasible. Referring to time travel - the future destination is reached by a computer using tensor calculus to change the present coordinates to ones in the future. To use a simple example confined to two dimensions: -1,+ i becomes +1, -i. This is interdimensional travel since it incorporates both the time and space elements of the time-space unity i.e. Wick rotation residing in the Mobius strips and doublets (a doublet is a pair of strips joined into a figure-8 Klein bottle) composing space and mass. Backwards travel in time is identical to forward trips except for the coordinates being different and belonging to points in the past.

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How might an Optimized Simulation be created? A model of the cosmos might be built that uses the infinite number pi and imaginary time, and resides in Virtual Reality (artificial, computer-generated simulation). The entanglement (both quantum and macroscopic) in the simulated universe is unable to remain separate from the entanglement existing in our perceived reality because computers using so-called "imaginary time" (which is defined by numbers with the property $i^2 = -1$) remove all boundaries between the two universes. This enables them to become one Augmented Reality (known now as technology that layers computer-generated enhancements onto an existing reality but seen here as the related layering of virtual reality onto other points in time and space). The poorly named imaginary time of physics and mathematics unites with pi (both are necessary to generate a non-Big-Bang cosmos i.e. an infinite universe which, because space and time can never be separated, is eternal). This manipulation of time, space, and the universe with virtual and augmented reality might possibly be produced by the two-valued binary-digit system used in electronics traversing a wormhole, or shortcut between folds in space and time, designed by humans of the far future. The augmented reality which is layered on “other” points in space-time actually isn’t transmitted to other points - because of the quantum entanglement of every particle (massive or massless) in spacetime, only one ever exists. This point is reminiscent of the sentence near the start of this article which says, “Then all the universe’s gravitational fields could be regarded as a single graviton”. Thus, transmissions to any (apparently other) places or times wouldn’t be restricted to the speed of light but are instantaneous. They only need to traverse the width of one graviton particle in order to reach infinite distances into the past, the future, or the physical universe. This extraordinary feat is elaborated on in the following elliptical (eVTS) Geometry [8]

## 2. Vector-Tensor-Scalar (VTS) and Elliptical VTS (eVTS) Geometries

The following method of building planets is preferred to collisions between rocks and dust in the disk because most planetary systems seem to outweigh the protoplanetary disks in which they formed, leaving astronomers to re-evaluate planet-formation theories. [9]

A vector is a quantity which possesses both magnitude and direction. Two such quantities may be represented by two adjoining sides of a parallelogram, so that their resultant is represented in magnitude and direction by the diagonal of the parallelogram (AD and CD, for example, can symbolize the electromagnetic and gravitational vectors ... while the resultant green diagonal of DB substitutes for the interaction of those two forces). A scalar variable is representable by a position on a line, having only magnitude e.g. the red dot on the diagonal, symbolic of the Higgs boson. A tensor is a set of functions which, when changing from one set of coordinates to another, is transformed in a precisely defined manner (e.g. changing from the coordinates of AD and CD to those of the green diagonal, or of the red dot, is a transformation performed in a particular way). [10]

Two sides thus illustrate the graviton's spin 2 and the photon's spin 1. 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 single scalar point on the diagonal. This scalar point is associated with particles of spin zero. [11] If the mass produced during the photon-graviton interaction (the energy and momentum of photons and presently hypothetical gravitons produces a pressure we call mass) happens to be 125 GeV/c^2, its union with spin 0 produces the Higgs boson.

### *2.1. Mass of Photon and Graviton*

The energy of a photon can be calculated using the formula $E = hf$ or $E = hc/\lambda$, where: E is the energy of the photon, h is Planck’s constant, f is the photon frequency, c is the speed of light, $\lambda$ is the photon wavelength. The photon energy at 1 μm wavelength, the wavelength of near-infrared radiation, is approximately 1.2398 eV. [12] The graviton’s existence is presently hypothetical and its mass is estimated at no more than $7.7\times10^{-23}$ eV/c^2. [13] Relativity states that mass and energy are interchangeable (E=mc^2 or m=E/c^2). Even though photons and gravitons may be massless, they

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still have energy. The energy can be thought of as mass which can be thought of as "frozen energy" (in this case, the particles of light and gravity might be classified as the aether).

*2.2. Quantum Spin of Photon and Graviton*

The pressure generated by photon-graviton interaction may be identified as mass, just as electromagnetic forces between your hand and the object you're touching are interpreted as the object's solidity. Photon-graviton interaction can, using William Rowan Hamilton's 1843 definition of quaternions as the quotient of two vectors, [14] produce ½ which is the quantum spin of all particles of matter. Photon spin is 1, graviton spin is 2, their interaction can also produce 2/1 which is the quantum spin of the graviton. An assembly of countless gravitons might form the intense gravity of a stellar, intermediate-mass, or supermassive black hole. Examples of quantum spin -

a) Photon divided by graviton = spin 1/2 of all matter particles
b) Graviton divided by photon = spin 2/1 which may be responsible for the intense gravity of black holes
c) Using time reversal in case of graviton: 1+2-2 = spin of nuclear-force bosons. It also equals photon spin - establishing a link between gravitation's spin 2, electromagnetism,and the nuclear forces
d) the Higgs boson's spin zero can be arrived at through (1-2) + 1 which uses the experimental interpretation of a photon existing in two places simultaneously (it uses the graviton's spin 2 being taken away from the photon's spin 1, and the spin motion of 1 being in more than one place at the same time).

## 3. Extending the Higgs Boson/Field of VTS Geometry to the Consciousness of eVTS Geometry

The parallelogram of Figure 2 can be converted by the morphing ability of computer programming so it traces the elliptical shape in Figure 3 – and the shape of Earth's elliptical orbit, which means the vector / tensor / scalar relationship applies to this planet. The vector can be the magnitude and direction of the orbiting Earth itself. It and a second vector (Earth months later in its orbit) are converted by tensor analysis into the coordinates of a single scalar point. Adding the geometrical objects of vector and tensor resulted in the object termed scalar. Successful conversion of the vectors in Figure 2's parallelogram to the vectors in Figure 3's ellipse, followed by tensor analysis, means our planet is also a scalar object. It has magnitude but, from this different eVTS frame of reference, no direction (in the classical system we're familiar with, Earth obviously has direction plus finite magnitude). The innumerable spins of particles composing the planet are reduced to that of a boson possessing integer spin. * Like a Bose-Einstein Condensate, such particles have no restriction on the number of them that occupy the same quantum state (their description and predicted behaviour). This lack of restriction is compatible with Earth never having any direction. This state is only possible if it has magnitude occupying a literally infinite and eternal amount of space-time, thus having no need of direction and being capable of possessing the same quantum state as any other body. The Earth appears obviously finite and insignificant because of the limitations of our technology (limited to this century, with no discernible input from future ones) together with the limits of our illusion-susceptible bodily senses. Since they'd need to adapt to Earth's infinity, all other bodies in space-time would similarly reduce the innumerable spins of particles composing them to that of a boson possessing integer spin which could be 0 (they'd only possess magnitude, would possess the same quantum state - and would be scalar, infinite bodies). Invoking infinity in its procedures, a quantum computer simultaneously uses the BITS (strings of 1's and 0's, reminiscent of String Theory) renaming them quantum bits or QUBITS.

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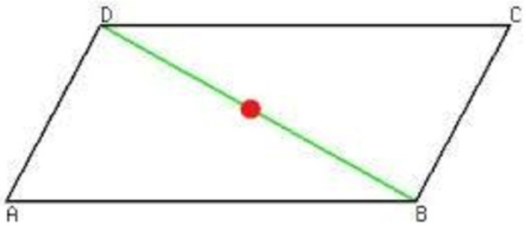


**Figure 2. - VTS (VECTOR-TENSOR-SCALAR) GEOMETRY -** Interaction of Gravitation and Electromagnetism Produces a Momentum in Gravitons and Photons (and a Pressure Which is Interpreted as Mass). (Figure drawn by author using "Paint" program).

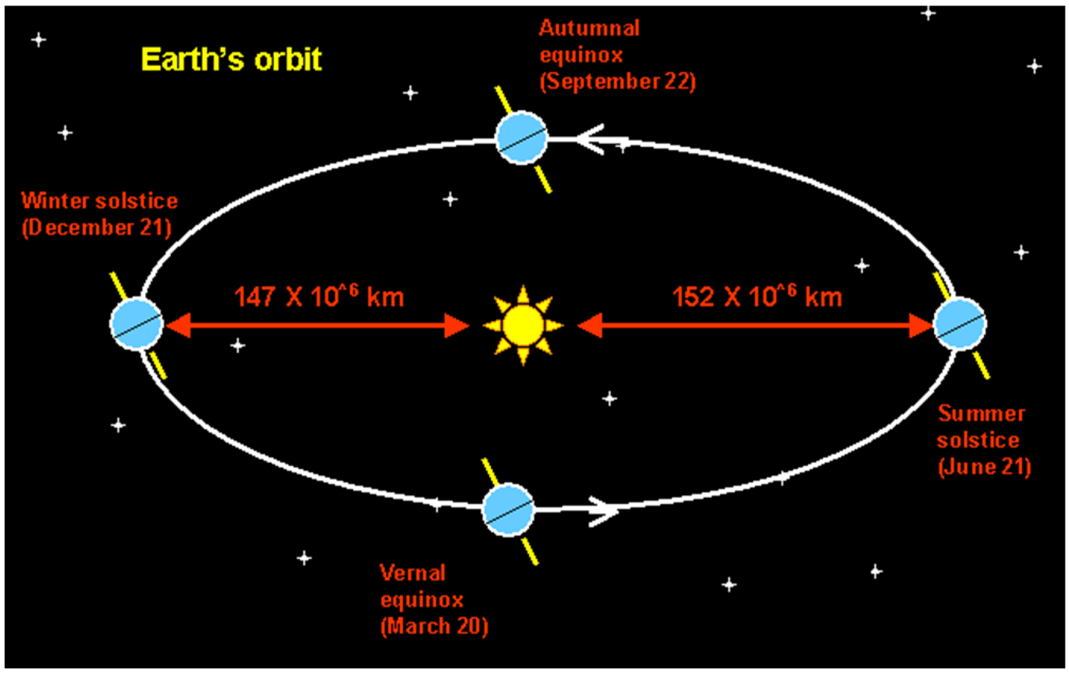


**Figure 3. Elliptical VTS Geometry: Earth's Orbit About The Sun Is An Ellipse**. Public domain image.

* Particles that are made of even numbers of fermions behave as a boson. The reason behind this is simple**:** each of those fermions obeys Fermi-Dirac statistics and is a spin ±1/2 particle. If you add two of them together, you can get something that's spin -1, 0,or +1, which is an integer (and hence a boson obeying Bose-Einstein statistics.) [15]

Occupying all time, vector-1 Earth must be united with vector-2 Earth (the one existing months later in its orbit). The scalar may be represented as a point on a line (see the first paragraph of the VTS section), and consequently limited to that point's boundaries. In this article, the scalar is a restricted point which is described by familiar mathematics. But simultaneously it's a boundaryless, unlimited field described by quantum-mechanical duality (simultaneously limited and unlimited), as well as by what are called imaginary numbers. * The scalar is without boundaries because it's associated with the zero spin of the Higgs boson, and thence with the cosmic Higgs field. So the scalar point identified with other bodies in space-time (including living bodies and minds) is actually part of the scalar field or Higgs field, with consciousness being boundaryless instead of being limited to one tiny part of space-time (the brain). Einstein's Theory of General Relativity says gravity is the curvature of space-time, and therefore IS space-time. The universal Higgs field can be identified as

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the universal gravitational field (together with the latter's constant interaction with the electromagnetic field).

* Professor Stephen Hawking says that boundaries and singularities exist in what is called "real" time but don't exist in what is termed "imaginary" time i.e. in time described with imaginary numbers. He also writes, "A scientific theory is just a mathematical model we make to describe our observations: it exists only in our minds. So it is meaningless to ask**:** Which is real, "real" or "imaginary" time? It is simply a matter of which is the more useful description." [16]

In "What Is Life?" [17], physicist Erwin Schrödinger reconciled this article's idea of co-existing scalar point and scalar field by a) believing that consciousness is highly dependent on the body (these are then a point manifestation), and b) being sympathetic to the Hindu concept of Brahman, by which each individual's consciousness is only a manifestation of a unitary consciousness pervading the universe (consciousness is then a field manifestation). Since the ultimate composition of our brains appears to be binary digits, our minds must be the same as the Artificial Intelligence of sufficiently advanced robots and computers).

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