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**MODERN SCIENCE EMPHASIZES MATHEMATICS. WHAT THE UNIVERSE LOOKS LIKE WHEN LOGIC IS EMPHASIZED (MATHS HAS A VITAL, BUT SECONDARY, ROLE IN THIS ARTICLE).**

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Abstract –

This article had its start with another article, concerned with measuring the speed of gravitational waves - "The Measurement of the Light Deflection from Jupiter: Experimental Results" by Ed Fomalont and Sergei Kopeikin (2003) - The Astrophysical Journal 598 (1): 704–711. This starting-point led to many other topics that required explanation or naturally seemed to follow on – Unification of gravity with electromagnetism and the 2 nuclear forces, Speed of electromagnetic waves, Energy of cosmic rays and UHECRs, Digital string theory, Dark energy+gravity+binary digits, Cosmic strings and wormholes from Figure-8 Klein bottles, Massless and massive photons and gravitons, Inverse square+quantum entanglement = God+evolution, Binary digits projected to make Prof. Greene's cosmic holographic movie, Renormalization of infinity, Colliding subuniverses, Unifying cosmic inflation, TOE (emphasizing "everything") = Bose-Einstein renormalized.

Content –

There is no limit on how fast space-time can stretch. The expansion can be much faster than the speed of light. Einstein said gravity is the curvature of space, and that objects follow the hills and valleys of that curved space. If there is no speed limit to the stretching of space, then there is no limit on how fast gravitational waves travel and Isaac Newton was correct to think the effects of gravity can be instantaneous (in his Philosophiæ Naturalis Principia Mathematica ["Mathematical Principles of Natural Philosophy"], first published in 1687). Gravitational damping (the rate of energy loss in, say, the Hulse-Taylor binary pulsar system - PSR B1913+16 is a pulsar which together with another neutron star forms a binary star system. In 1974 it was discovered by Russell Hulse and Joseph Taylor of the University of Massachusetts) does not imply that gravity's speed cannot be infinite. Just as there is no upper limit to the speed of gravity waves, there is no lower limit on how fast space-time can stretch. Gravitational waves – the stretching of spacetime – that possess exactly the same speed as light, as general relativity predicts, is only one of the possible speeds of gravity, and it's possible because gravitation is unified with electromagnetism (as the following paragraph explains):

Suppose Albert Einstein was correct when he said gravitation plays a role in the constitution of elementary particles (in "Do Gravitational Fields Play An Essential Part In The Structure of the Elementary Particles?" – a 1919 submission to the Prussian Academy of Sciences). And suppose he was also correct when he said gravitation is the warping of space-time. Then it is logical that 1) gravitation would

play a role in constitution of elementary particles, and their mass, and also in the constitution of the nuclear forces associated with those particles, and 2) the warping of space-time that produces gravity means space-time itself plays a role in the constitution of elementary particles, their mass, and the nuclear forces. Electromagnetism is not separate from space but is waves within it - the frequencies and wavelengths of these waves identify them as electromagnetic. Gravity, being united with EM and the nuclear forces, is therefore the ultimate physical source of all repelling and attracting (from the attractive strong nuclear force to the repulsive dark energy).

Since there is no upper or lower limit to how fast space-time can stretch, the waves that are part of it and are identified as electromagnetic do not have to always travel at the speed of light (approximately 299,792 kilometres [186,282 miles] per second).

"On May 10, 2009, Fermi and other satellites detected a so-called short gamma ray burst, designated GRB 090510. Astronomers think this type of explosion happens when neutron stars collide. Ground-based studies show the event took place in a galaxy 7.3 billion light-years away. Of the many gamma ray photons Fermi's LAT (Large Area Telescope) detected from the 2.1-second burst, two possessed energies differing by a million times. Yet after traveling some seven billion years, the pair arrived just nine-tenths of a second apart. "  
([http://www.nasa.gov/home/hqnews/2009/oct/HQ\\_09-254\\_Fermi\\_anniversary.html](http://www.nasa.gov/home/hqnews/2009/oct/HQ_09-254_Fermi_anniversary.html))

"Many approaches to new theories of gravity picture space-time as having a shifting, frothy structure at physical scales trillions of times smaller than an electron. Some models predict that the foamy aspect of space-time will cause higher-energy gamma rays to move slightly more slowly than photons at lower energy." ([http://www.nasa.gov/home/hqnews/2009/oct/HQ\\_09-254\\_Fermi\\_anniversary.html](http://www.nasa.gov/home/hqnews/2009/oct/HQ_09-254_Fermi_anniversary.html))

Let's take the approach that, instead of the higher-energy gamma rays moving more slowly, the lower-energy gamma photons increase their speed from their speed at emission (electromagnetic waves do not have to always travel at the speed of light). Spacetime/gravity gives energy to the less energetic particle, allowing it to quickly match the other's speed and travel at the speed of light (it lags 900 milliseconds behind because it took that long to catch up to the other's speed, and Lightspeed cannot be exceeded). And it confers energy (and mass) \* on cosmic rays that travel far through space, turning them into UHECRs (ultra-high-energy cosmic rays). UHECRs can be emitted by supermassive black holes in Active Galactic Nuclei but can also acquire their energy when cosmic rays travel far through space. This conflicts with the theoretical upper limit on the energy of cosmic rays,  $5 \times 10^{19}$  eV or about 8 joules and called the Greisen–Zatsepin–Kuzmin limit (GZK limit). Charged particles travelling through space with energies a billion times this limit are suitable as a probe into realms where

the theory of special relativity breaks down. Physicist Lee Smolin has written that if such cosmic rays can be confirmed, it "would be the most momentous discovery of the last hundred years—the first breakdown of the basic theories comprising the twentieth century's scientific revolution." (Smolin, Lee – "The Trouble With Physics" - Houghton Mifflin Harcourt, 2006, p. 222)

\* Mass increase at increasing accelerations is inevitable because the object is encountering more spacetime and gravity - the producers of mass, including that of the Higgs boson ( $126 \pm 0.4 \text{ GeV}/c^2$ , according to "Observation of a New Particle in the Search for the Standard Model Higgs Boson with the ATLAS Detector at the LHC" by the ATLAS Collaboration - Physics Letters B 716 (1): 1–29).

An even more basic mathematical, as opposed to physical, source (of the universe, space-time, and gravitation) is revealed in the following - The strings of physics' string theory may be the binary digits of 1 and 0 used in computers and electronics. The digits are constantly switching between their representations of the "on" and "off" states. This switching is usually referred to as a flow or current. ^ Currents in the two 2-dimensional programs called Mobius loops<sup>1</sup> are connected into a four-dimensional Klein bottle<sup>2</sup> by the infinitely-long irrational and transcendental numbers. Such an infinite connection translates - via bosons being ultimately composed of 1's and 0's depicting  $\pi$ ,  $e$ ,  $\sqrt{2}$  etc.; and fermions being given mass by bosons interacting in matter particles' "wave packets"<sup>3</sup> – into an infinite number of Klein bottles. Each Klein 1) is one of the universe's subuniverses (our own is 13.8 billion years old), 2) is made flexible through its binary digits which seamlessly, or almost seamlessly, join it to surrounding subuniverses and eliminate its central hole, and 3) possesses warped time and space because its foundation is the programmed curves in its mathematical Mobius loops. The universe functions according to the rules of fractal geometry. So the Mobius does not exist only at the cosmic level. It also manifests at the quantum scale, giving us photons and protons etc. Space and time are no longer separate in modern science, but are an indivisible space-time. So if space and the universe are infinite (addressed later), how can time not be eternal? The past and the future must both extend forever (the idea of time being finite arises from confusion of our subuniverse with the one infinite universe). BITS (BInary digiT) only suggest existence of the divine if time is linear. Although a non-supernatural God is proposed via the inverse-square law's infinite aspect<sup>4</sup> coupled with eternal quantum entanglement, Einstein taught us that time is warped. Warped time is nonlinear, making it at least possible that the BITS composing space-time and all particles originate from the computer science of humans.\*

^ Nothing can be truly isolated when we consider the universe as a unification caused by 1's and 0's, but our physical senses and scientific instruments don't detect binary digits and our senses/instruments thus reinforce the illusion of isolation.

\* Maybe hidden variables called binary digits could permit time travel into the future by warping positive space-time. And maybe they'd allow time travel into the past by warping a 5D hyperspace # that is translated 180 degrees to space-time, and could be labelled as negative or inverted. (The space-time we live in is described by ordinary [or "real"] numbers which, when multiplied by themselves, result in positive numbers e.g.  $2 \times 2 = 4$ , and  $-2 \times -2$  also equals 4. Inverted "positive" space-time becomes negative hyperspace which is described by so-called imaginary numbers that give negative results when multiplied by themselves e.g.  $i$  multiplied by itself gives  $-1$ .) The past can never be changed from what occurred, and the future can never be altered from what it will be. Both are programmed by the 1's and 0's.

# This 5th-dimensional hyperspace would be tinier than a subatomic particle, like the dimensions invoked by string theory (about 70% of space consists of dark energy, according to the WMAP and Planck space probes – which is interpreted in this article as 70% of a particle also consisting of dark energy since "space-time itself plays a role in the constitution of elementary particles and the nuclear forces" (see paragraph above about Einstein's 1919 submission to the Prussian Academy of Sciences). This dark energy can be associated with hyperspace and its binary digits, so a) 70% of a particle is composed of hyperspace, and b) the extra dimension also exists everywhere in empty space. With a single extra dimension of astronomical size, gravity is expected to cause the solar system to collapse ("The hierarchy problem and new dimensions at a millimetre" by N. Arkani-Hamed, S. Dimopoulos, G. Dvali - [Physics Letters B - Volume 429, Issues 3–4](#), 18 June 1998, Pages 263–272, and "Gravity in large extra dimensions" by U.S. Department of Energy - <http://www.eurekalert.org/features/doe/2001-10/dbnl-gil053102.php> However, collapse never occurs if gravity accounts for repulsion as well as attraction on both subatomic and astronomical scales (accounts for dark energy and familiar concepts of gravity, as well as repelling aspects of the electroweak force - such as placing two like magnetic poles together - and attracting electroweak/strong force aspects).

<sup>1</sup> Let's borrow a few ideas from string theory's ideas of everything being ultimately composed of tiny, one-dimensional strings that vibrate as clockwise, standing, and counterclockwise currents in a four-dimensional looped superstring. We can visualize tiny, one dimensional binary digits of 1 and 0 (base 2 mathematics) forming currents in a Mobius loop – or in 2 Mobius loops, clockwise currents in one loop combining with counterclockwise currents in the other to form a standing current. The 2 loops' currents are connected into the four-dimensional looped superstring of a four-dimensional Klein bottle possessing looped or nonlinear space-time.

<sup>2</sup> Discovery.com (March 18, 2010) says: "The universe is not only expanding -- it's being swept along in the direction of constellations Centaurus and Hydra at a steady clip of one million miles per hour, pulled, perhaps, by the gravity of

another universe." (this is called "the dark flow") Could this be describing evidence of an idea suggested by mathematics' "Poincare conjecture", which has implications for the universe's shape and says you cannot transform a doughnut shape into a sphere without ripping it. One interpretation: This can be viewed as subuniverses shaped like Figure-8 Klein Bottles gaining rips called wormholes when extended into the spherical spacetime that goes on forever (forming one infinite superuniverse). Picture spacetime existing on the surface<sup>5</sup> of this doughnut which has rips in it. These rips provide shortcuts between points in space and time – and belong in a 5<sup>th</sup>-dimensional hyperspace. The boundary where subuniverses meet could be called a Cosmic String (analogous to cracks that form when water freezes into ice and first contemplated by the theoretical physicist Tom Kibble in the 1970s, cosmic strings are "cracks" in spacetime formed as subuniverses cool, are extremely thin (the diameter of a proton, or smaller), and have immense density ( $10^{19}$  kg/cm, according to Penguin Encyclopedia, Edited by David Crystal – Penguin Reference Library 2006). This density would vary between any two subuniverses since it depends on the mass and energy content of the boundary regions of the two subuniverses, as well as movement of their boundary (the cosmic string) caused by expansion of the subuniverses – because the relativistic motion of each boundary causes enormous quantities of energy to be converted into mass.

<sup>3</sup> When gravitons and photons transfer energy to each other,  $E=mc^2$  ("Does the Inertia of a Body Depend Upon Its Energy Content?" by Albert Einstein - "Annalen der Physik" - November 21, 1905) says the relation of mass to energy means they're transferring mass, too. Another way to view their interaction is – the product of gravity interacting with electromagnetism is what we call "mass"; the gravitons and photons therefore give mass to each other. Experiments conducted by the Particle Data Group ("Review of Particle Physics" - Physics Letters B, Volume 667, Issues 1–5, 11 September 2008, Pages 1–6) say the mass of a single photon is no more than  $10^{-18}$  eV/c<sup>2</sup>.

"Mass of the graviton" by Alfred S. Goldhaber and Michael Martin Nieto - Phys. Rev. D 9, 1119–1121 (1974) - says "...although it is not known if the graviton exists, one can still say that its rest mass is less than  $2 \times 10^{-62}$  g. It's important to note that this paragraph is referring to either subluminal or rest mass of the photon. In other articles e.g. "Equation Describing the Universe" (<http://vixra.org/abs/1305.0030>), I refer to photons as massless. This is their state at the speed of light (the same applies to gravitons for electromagnetic and gravitational waves are both parts of, and disturbances in, the fabric of space-time) –

"It's impossible to point to the 4th dimension of time, so this cannot be physical. Since the union of space-time is well established in modern science, we can assume the 4th dimension is actually measurement of the motions of the particles occurring in the 3 dimensions of length, width, and height. The basic standard of time in the universe is the measurement of the motions of photons - specifically, of the speed of light. This is comparable to the 1960's adoption on

Earth of the measurement of time as the vibration rate of cesium atoms. Suppose that at lightspeed, time = 0 (it is stopped). Below 300,000 km/sec, in accord with Relativity, acceleration or gravitation causes time dilation (slowing of time as the speed of light is approached). If time's 0, space is also 0 because space and time coexist as space-time whose warping (gravity) is necessarily 0 too. Spacetime/gravity form matter/mass, so the latter pair can't exist at lightspeed and photons are massless."

<sup>4</sup> A non-supernatural God is proposed via the inverse-square law's infinite aspect coupled with eternal quantum entanglement, but Einstein taught us that time is warped. Warped time is nonlinear, making it at least possible that the BITS composing space-time and all particles originate from the computer science of humans - Binary digiTS only suggest existence of the divine if time is linear. God would be a suprapantheistic union of the universe's parts; forming a union with humans in a cosmic unification, and forming a universal intelligence. Science's Law of Conservation says the total mass (or matter) and energy in the universe does not change, though the quantity of each varies (I interpret this Law as saying – to get matter and energy, you have to start with matter and energy; which means that time must be warped and nonlinear). So subtracting future time-travelling, terraforming, bioengineering humans makes it impossible to assemble complex plants and animals, whose adaptations are often called evolution.

<sup>5</sup> British quantum physicist David Bohm (1917-1992) said "Our brains mathematically construct objective reality by interpreting frequencies that are ultimately projections from another dimension, a deeper order of existence that is beyond both space and time."  
(<http://www.spaceandmotion.com/Physics-David-Bohm-Holographic-Universe.htm>) In "The Hidden Reality" - Knopf (January 25, 2011), Brian Greene writes "... reality ... may take place on a distant boundary surface, while everything we witness in the three common spatial dimensions is a projection of that faraway unfolding. Reality, that is, may be akin to a hologram. Or, really, a holographic movie." Brian Greene's "...projection of that faraway ... reality that is ... akin to a holographic movie" and David Bohm's "...projections from another dimension ... that is beyond both space and time" could be interpreted as projections of binary digits from a 5<sup>th</sup>-dimensional hyperspace which become matter, energy, force and space-time in the known 4 dimensions. How could "space-time itself play a role in the constitution of elementary particles, their mass, and the nuclear forces"? (see second paragraph) Because gravitation and electromagnetism interact to form particles, and gravitation is the warping of space-time while electromagnetism is not separate from space-time but is waves in it. Binary digits in hyperspace control the space-time that produces particles, much as binary digits in a computer control the motors that produce work. The work contains both the computer and motors (without either of these, no work is done). Similarly, all particles contain both space-time and hyperspace. (In a

universe described by fractal geometry, the 5th dimension wouldn't exist only on a cosmic scale but also as a hyperspace in every fermion and boson.) Mobius loops are the foundation of particles. The 3 familiar dimensions of length, width and height along, for example, the left side of a Mobius loop – for convenience, the relative positions of the 2 Mobius loops previously referred to can be thought of as the orientation of a single loop - would have a 4<sup>th</sup> dimension (time) perpendicular to them. And there would also exist a 5th dimension called hyperspace, at right angles to the 4th and 180 degrees from the length/width/height i.e. on the right. H-space is extended from the side along the loop's bottom – and even “invades” the spatial and temporal dimensions which it produces - because the WMAP space probe (Wilkinson Microwave Anisotropy Probe) has determined that a very large 72% of the universe is dark energy ... and transmissions of binary digits from hyperspace (the mechanism of space-time and particle production) are an interpretation of dark energy. The elimination of distance, both in time and in space, by electronic infinity or  $e\infty$  (see <sup>6</sup> and <sup>7</sup>) supports the idea of Professor Greene's “distant” and “faraway” unfolding / David Bohm's “dimension beyond space and time” being as near as the quantum space of a subatomic particle in your or my brain.<sup>8</sup>

Bob Berman's article "Infinite Universe" (“Astronomy” – Nov. 2012) says, “The evidence keeps flooding in. It now truly appears that the universe is infinite” and “Many separate areas of investigation – like baryon acoustic oscillations (sound waves propagating through the denser early universe), the way type 1a supernovae compare with redshift, the Hubble constant, studies of cosmic large-scale structure, and the flat topology of space – all point the same way.” Science's Law of Conservation says neither matter nor energy can be created or destroyed (though the quantity of each can change). So, in what form did the matter and energy making up you and me exist before birth, and in what form will it exist after death? If the human relationship with the infinite universe can be described with a Unified Field Theory, people must be unified with that cosmos and every one of us must possess the potential for infinite (immortal) life.

Support for the article – After examining recent measurements by the Wilkinson Microwave Anisotropy Probe, NASA declared "We now know that the universe is flat with only a 0.4% margin of error. This suggests that the Universe is infinite in extent" – “WMAP's Universe”: [http://map.gsfc.nasa.gov/universe/uni\\_shape.html](http://map.gsfc.nasa.gov/universe/uni_shape.html); and according to "The Early Universe and the Cosmic Microwave Background: Theory and Observations" by Norma G. Sánchez, Yuri N. Parijskij [published by Springer, 31/12/2003], the shape of the Universe found to best fit observational data is the infinite flat model).

The evidence indicates that the universe is physically infinite. Evidence also indicates the universe is expanding. How can the infinite expand? We could simply say it obviously doesn't, and cling to the old concept of a finite space without an edge (like the surface of a sphere). But this would be an incomplete

explanation because it ignores the idea that other expanding subuniverses can collide with ours and their galaxies enter our space to keep our galaxy company. (see "Cosmic evolution in a cyclic universe" by Paul Steinhardt and Neil Turok - Phys. Rev. D 65, 126003 (2002) [20 pages]). It also ignores <http://discovermagazine.com/2009/oct/04-will-our-universe-collide-with-neighboring-one#.UY3YTKL-Gbs> that speaks of the "axis of evil", an unexpected alignment of cold and hot (denser and less dense) spots in the cosmic microwave background; one of the possible explanations of this being collision with another universe (other proposals are that the universe's inflation wasn't perfectly symmetrical, and that the entire universe is rotating).

It makes sense that the infinite<sup>6</sup> universe is static and that it consists of an infinite number of expanding "subuniverses". As one of these expands, it collides with its neighbours and their galaxies enter its space. This idea reminds us of the idea that inflation may have created multiple universes. Whereas inflation suggests separation between universes and formation of a "multiverse", expanding subuniverses suggests unification of the subuniverses as inseparable parts of the greater universe.

<sup>6</sup> The inverse-square law states that the force between two particles becomes infinite if the distance of separation between them goes to zero. Remembering that gravitation (associated with particles) partly depends on the distance between their centres, the distance of separation only goes to zero when those centres occupy the same space-time coordinates (not merely when the particles' or objects' sides are touching i.e. infinity equals the total elimination of distance<sup>7</sup>). The infinite cosmos could possess this absence of distance in space and time, via the electronic mechanism of binary digits. To distinguish this definition from "the universe going on and on forever (physical infinity)", we can call it "electronic infinity or  $e\infty$ ".

<sup>7</sup> Infinity does not equal nothing - total elimination of distance, both in time and in space, produces nothing in a physical sense and reverts to theoretical physicist Lee Smolin's imagining of strings as "not made of anything at all" (p.35 of Dr. Sten Odenwald's article "What String Theory Tells Us About the Universe": Astronomy – April 2013). It also reverts the universe to the mathematical blueprint from which physical being is constructed (this agrees with cosmologist Max Tegmark's hypothesis that mathematical formulas create reality, <http://discovermagazine.com/2008/jul/16-is-the-universe-actually-made-of-math#.UZsHDalwebs> and <http://arxiv.org/abs/0704.0646>). So, infinity = something, agreeing with Dr. Sten Odenwald's statement on p.32 of his article, that "The basic idea is that every particle of matter ... and every particle that transmits a force ... is actually a small one-dimensional loop of *something*."

<sup>8</sup> There is a scientific explanation that says there is no such thing as separation into "me" and "you", but only unification of the entire universe and all time. In this context, me and you are actually the same thing. It's impossible to not focus on

others because even when concentrating on our self; you and I are focusing on, and benefiting, the community. A candidate for "Equation Describing the Universe" shows how this state of affairs (inexplicable to our bodily senses and scientific instruments) can exist -

$$H_u = (\text{BEc})^{(e \infty)}, \text{ or } 1 = 1^\infty$$

This equation looks like the one physicists are hoping will be printed on T-shirts in the middle of this century as a description of the Universe. Normally, I'd leave development of this equation in the capable hands of Isaac Newton or Albert Einstein. They aren't here right now ... and it'll be quite a while before they return. However, they instructed me to send you this message on their behalf.

H is for the Hamiltonian, representing the total energy of a quantum mechanical system. The subscript u stands for "universe" and  $H_u$  means the universe operates quantum mechanically (quantum effects operate macroscopically as well as microscopically, and this unification is symbolized by the first 1). BEc is for Bose-Einstein condensate, a finite form of matter that is the first known example of quantum effects becoming apparent on a macroscopic scale (represented by the second 1). The inverse-square law states that the force between two particles becomes infinite if the distance of separation between them goes to zero. Remembering that gravitation (associated with particles) partly depends on the distance between the centres of objects, the distance of separation between objects only goes to zero when those centres occupy the same space-time coordinates (not merely when the objects' sides are touching i.e. infinity equals the total elimination of distance - the infinite cosmos could possess this absence of distance in space and time, via the electronic mechanism [computer wizardry] of binary digits). To distinguish this definition of infinity from "the universe going on and on forever", we can call it "electronic infinity or e infinity" (not  $E_8$ , for the infinity symbol is an 8 lying on its side). When the macroscopic quantum effects of the BEc are magnified by e infinity, those effects are instantly translated into all space-time operating quantum mechanically. In other words, you can multiply a BEc (the second 1) an infinite number of times - but no matter how many (or how few) times you do it (using an integer or whole number), you'll always end up with 1 (the macroscopic universe's time and space operating quantum mechanically). Consequent to this operation is the inevitable quantum entanglement of everything (matter, energy, forces, females and males); making all space and all time a unification.

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