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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, Isolation is an illusion, 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, Physically infinite universe, Colliding subuniverses, Unifying cosmic inflation, Theory Of Everything (emphasizing "EVERYthing") = Bose-Einstein renormalized. The text also addresses (in a nonmathematical way) the wavelength of electromagnetic waves, the frequency of gravitational waves, gravitational and electromagnetic waves having identical speed, the gamma-ray burst designated GRB 090510, the smoothness of space, Self-influence and ESP caused by quantum entanglement in time, and Human involvement in the retrocausality of gravity, electromagnetism and matter. Topics in this article's PS and PPS include – Gravitational waves actually have a much shorter wavelength than gamma rays, but are extraordinarily weak because almost all that energy goes into the formation of matter – How the Law of Conservation works – Mathematicians, physicists and Richard Feynman – Time travel to the past – Interstellar and intergalactic travel – Nonsupernatural God – 5<sup>th</sup> dimensional hyperspace – Dark Matter - Variable Speed of Light – Trillions of millennia in the distant future.

**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):

### **Unification of gravity with electromagnetism and the 2 nuclear forces**

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. Matter can be thought of as "coherent space" that is bound by forces<sup>0</sup> and gravity, being united with EM and the nuclear forces, is the ultimate physical source of all repelling and attracting (from the attractive strong nuclear force to the repulsive dark energy).

<sup>0</sup> This makes sense to me because of Einstein's paper saying gravitation may be involved in the structure of particles. Gravity is only the warping of space, which means space (or space-time) itself may be involved in the structure of particles. To understand how this could happen, we need to remember that higher-frequency light (in the visible part of the electromagnetic spectrum) can be converted into lower-frequency infrared light (by being absorbed as visible light and re-emitted at infrared wavelengths by interstellar gas and dust). Similarly, the gravitational waves of space could have a frequency even greater than gamma rays. When converted into lower frequencies, they'd produce the electromagnetic wavelengths which Einstein's paper suggests interact with gravity to form particles of matter ( $E=mc^2$  would probably describe the conversion from gravitational energy to the "coherent, organized energy" that is matter).

For a brief overview (without equations) of how true gravitational-electromagnetic unification is achieved mathematically, see "Digital string theory".

### **Speed and wavelength of electromagnetic waves**

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). Picture space-time as a balloon made of springs (these represent electromagnetic waves). When space expands (when the balloon stretches), the springs expand or stretch by the same amount i.e. the EM waves increase their wavelength. They also appear to increase their speed because they cover, in the same period of time, more distance on the balloon's surface after it has been stretched than they would have prior to the stretching. However, the increase is relativistic - they're still actually travelling at 299,792 kilometres a second. The increased speed is entirely due to the stretching of space (EM waves cover more distance because their own speed is added to the stretching of space-time). However, the speed of EM waves can vary because space-time itself plays a role in the constitution of elementary particles, which means the motions of particles may be viewed as expansion and contraction of space. Light's speed in vacuum is  $3 \times 10^8$  metres/second,  $2.26 \times 10^8$  m/s in water and  $1.97 \times 10^8$  m/s in glass (also see the example below of high-energy and low-energy gamma rays).

The increase in wavelength (and resultant decrease in frequency) due to space's expansion actually occur, though. Since space-time itself plays a role in the constitution of elementary particles, this can be viewed as absorption of higher frequencies by interstellar gas and dust, with those frequencies being re-emitted at lower energies and frequencies. Scientists sometimes give matter the name "organized energy" because atomic particles often behave like small bundles of energy arranged in definite patterns. So the highest frequencies are those of gravitational energy – the spacetime warping essential to particle formation (the "springs" or EM waves that are part of space-time are the other ingredients of particle formation, in agreement with Einstein's paper "Do Gravitational Fields Play An Essential Part In The Structure of the Elementary Particles?" (in which he writes

**N** **EITHER** the Newtonian nor the relativistic theory of gravitation has so far led to any advance in the theory of the constitution of matter. In view of this fact it will be shown in the following pages that there are reasons for thinking that the elementary formations which go to make up the atom are held together by gravitational forces.

vanish. Therefore, by equation (1), we cannot arrive at a theory of the electron by restricting ourselves to the electromagnetic components of the Maxwell-Lorentz theory, as has long been known. Equation (1) is

$$G_{\mu\nu} - \frac{1}{2}g_{\mu\nu}G = -\kappa T_{\mu\nu}$$

where  $G_{\mu\nu}$  denotes the contracted Riemann tensor of curvature,  $G$  the scalar of curvature formed by repeated contraction, and  $T_{\mu\nu}$  the energy-tensor of "matter." The assumption that the  $T_{\mu\nu}$  do *not* depend on the derivatives of the  $g_{\mu\nu}$  is in keeping with the historical development of these equations.

### **Frequency of gravitational waves and their identical speed to electromagnetic waves**

We might assume the green section of the visible portion of the electromagnetic spectrum is the average of EM energy (photon energy = approx. 2 eV). At lower frequencies are infrared, microwave, then radio. At higher frequencies are ultraviolet, x-rays, then gamma rays. The difference between gravity's strength and EM's strength is  $10^{36}$ . However, gravity is the weaker partner despite having the higher frequency (with a boson energy in the order of 2 trillion trillion trillion times that of "green" photons). This is because nearly all that goes into the "organized energy" forming a particle, which then re-emits some of that energy at reduced electromagnetic frequencies, including those of gamma radiation. (Just as visible light can be absorbed and re-emitted at lower infrared frequencies which have the same speed, gravitational waves can be absorbed then re-emitted at lower electromagnetic frequencies which have the same speed.) The EM contribution to a particle's formation is the tiniest fraction of the tiniest fraction of 1% of gravity's because EM is waves in space-time (not something separate from the warping of space-time that is gravity). In other words - EM plays a secondary, subordinate role to gravity which, being united with EM and the nuclear forces, is the ultimate physical source of all repelling and attracting (from the attractive strong nuclear force to the repulsive dark energy). People are accustomed to thinking matter and energy are converted into each other only under unusual circumstances like radioactivity, nuclear explosions and in the Large Hadron Collider. But the conversions are happening all the time in every particle of every atom and every beam of energy.

### **The gamma-ray burst designated GRB 090510**

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))

## **Energy of cosmic rays and UHECRs**

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 ( $126 \pm 0.4$  GeV/c<sup>2</sup>, 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).

## **The smoothness of space**

Of course, there are circumstances in which the gamma photon with more energy (more electron volts) could be emitted at the same time as the lower-eV photon, yet be the one that arrives in the Fermi satellite's detectors nine-tenths of a second later. This would rightfully cause the Fermi researchers to claim space is smooth and that the photon was not hindered by the supposed "shifting, frothy structure at physical scales trillions of times smaller than an electron". What could cause this smoothness?

## Digital string theory

It could be the result of an even more basic mathematical, as opposed to physical, source (of the universe, space-time, and gravitation) as revealed in the following (so could EM waves, thus producing gravitational-electromagnetic unification) - 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<sup>^</sup>. 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 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, 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 digITS) 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.\*

## Isolation is an illusion

<sup>^</sup> 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. A lack of isolation means a high-energy gamma photon is not hindered by rough spots because those spots would be pockets of isolated activity. Space-time is as smooth as a website without glitches or bugs (it presents no obstacles to clicks or reading). Einstein predicted space-time is smooth.

\* 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.

### **Self-influence and ESP caused by quantum entanglement in time**

I think I'd like to say something about "landscapes in time". We can't see past the horizon on our planet - yet we know there are things beyond that horizon (land, water, sky, people, cities, countries, etc. etc.) Neither can we see past the "horizon" of the fleeting time we live in. For some reason though, it is usually assumed other times simply don't exist. The proposed "Equation Describing the Universe" (see <sup>8</sup> at end of article) means quantum processes, in which effects and causes are not necessarily separated, wouldn't be confined to tiny subatomic scales but would also occur on large macroscopic scales. In turn, this means embryonic development would follow rules of quantum entanglement and retrocausality and must be instant in a real sense, even though we can't perceive it that way. How could an embryo (indeed, a fully formed plant or animal) exist simultaneously with its egg cell? Suppose time is like the playing of a DVD or video tape. The entire disc or tape obviously exists all the time. But our physical senses can only perceive a tiny part of the sound and the sights at any fraction of a second. How can travel into both the future and past not be possible if ALL time always exists? Since quantum processes occur on scales up to, and including, the cosmic; egg cell and adult would, defying our senses and experiments, instantly affect each other and thus actually coexist - in different times - in this cosmos unified by binary digits' production of gravity, the universe's physical foundation. The 1's and 0's of binary digits would be an even more basic, mathematical foundation and would program the past to be unchangeable from what has happened, and the future to be unalterable from what it's destined to be. And if DVDs themselves could be said to correspond to our spatial and temporal environment along with our bodies and brains, could the laser which reads the data on the disc correspond in this analogy to consciousness? In a cosmic-quantum unification where all parts of a disc - and its player's laser - form a unity; wouldn't it be possible for consciousness to read data from anywhere on a disc (suggesting consciousness is not limited to sensory perception)? If the past and future really do exist, then time travel is no more foolish than travelling beyond the horizon on our world - especially since science has not regarded space and time as separate since the days of Einstein (science speaks of space-time now).

### **Dark energy + gravity + binary digits**

# 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).

To conclude this section – Gravity produces electromagnetism. Retrocausally (by means of humans travelling into the past of this subuniverse with their electronics); this “Cosmic EM Background” produces base-2 mathematics, which produces gravity. EM interacts with gravity to produce particles, mass – gravity/EM could be termed “the Higgs field” - and the nuclear forces associated with those particles. It makes gravity using BITS that copy the principle of magnetism attracting and repelling, before pasting it into what we call the strong force and dark energy.

<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.

### **Cosmic strings and wormholes from Figure-8 Klein bottles**

<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.

### **Massless and massive photons and gravitons**

<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."

### **Inverse square + quantum entanglement = God + evolution**

<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.

### **Binary digits projected to make Prof. Greene's cosmic holographic movie**

<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>

### **Physically infinite universe**

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).

### **Colliding subuniverses**

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-neighbor-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).

### **Unifying cosmic inflation**

It makes sense that the infinite universe<sup>6</sup> 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.

### **Renormalization of infinity**

<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*."

### **Theory Of Everything (emphasizing "EVERYthing") = Bose-Einstein renormalized**

<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 -

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

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.

## PS

On the website researchgate.net, Zhen-Hua Zhang from the Department of Physics at Huazhong (Central China) Normal University responded to my question (and partial answer to that question) "Can an infinite universe expand?" During our correspondence, he also forwarded to me the Scientific American (February 21, 2005) article "Misconceptions about the Big Bang. Baffled by the expansion of the universe? You're not alone. Even astronomers frequently get it wrong" By Charles H. Lineweaver and Tamara M. Davis

[http://space.mit.edu/~kcooksey/teaching/AY5/MisconceptionsabouttheBigBang\\_ScientificAmerican.pdf](http://space.mit.edu/~kcooksey/teaching/AY5/MisconceptionsabouttheBigBang_ScientificAmerican.pdf)

This is the reply I gave –

I found that article very interesting. When I said space-time and the matter in galaxies is ultimately made of the same thing, I wasn't suggesting that the galaxies are expanding like space. Galaxies are indeed coherent structures that are bound by forces. They aren't expanding like empty space, and can therefore be at rest. They can still be considered as having the same composition as space at the most fundamental level i.e. they can be thought of as "coherent space".

This makes sense to me because of Einstein's paper saying gravitation may be involved in the structure of particles. Gravity is only the warping of space, which means space (or space-time) itself may be involved in the structure of particles. To understand how this could happen, we need to remember that higher-frequency light (in the visible part of the electromagnetic spectrum) can be converted into lower-frequency infrared light (by being absorbed as visible light and re-emitted at infrared wavelengths by interstellar gas and dust). Similarly, the gravitational waves of space could have a frequency even greater than gamma rays.<sup>10</sup> When converted into lower frequencies, they'd produce the electromagnetic wavelengths which Einstein's paper suggests interact\* with gravity to form particles of matter<sup>11</sup> ( $E=mc^2$  would probably describe the conversion from gravitational energy to the "coherent, organized energy" that is matter).

\* 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  $10^{-18} \text{ eV}/c^2$ .

“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  $2 \times 10^{-62} \text{ g}$ . 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) – “Equation Describing the Universe” states: “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<sup>9</sup>. Spacetime/gravity form matter/mass, so the latter pair can't exist at lightspeed and photons are massless.”

I found a few other helpful things in the article you sent - the balloon analogy, the sentence “Although the light beam is traveling toward us at the maximum speed possible, it cannot keep up with the stretching of space.” (referring to the Hubble distance of 14 billion light-years), and the sentences “Having a recession velocity greater than the speed of light does not violate special relativity. It is still true that nothing ever overtakes a light beam.” I wrote these lines in an article sent to vixra.org -

“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). Picture space-time as a balloon made of springs (these represent electromagnetic waves). When space expands (when the balloon stretches), the springs expand or stretch by the same amount i.e. the EM waves increase their wavelength. They also appear to increase their speed because they cover, in the same period of time, more distance on the balloon's surface after it has been stretched than they would have prior to the stretching. However,

the increase is relativistic - they're still actually travelling at 299,792 kilometres a second. The increased speed is entirely due to the stretching of space (EM waves cover more distance because their own speed is added to the stretching of space-time). However, the speed of EM waves can vary because space-time itself plays a role in the constitution of elementary particles, which means the motions of particles may be viewed as expansion and contraction of space. Light's speed in vacuum is  $3 \times 10^8$  metres\second,  $2.26 \times 10^8$  m\s in water and  $1.97 \times 10^8$  m\s in glass ."

## **How the Law of Conservation works**

About "the expansion of the universe now seems to be accelerating" - this appears to be consistent with what I wrote in my first reply to you. The binary digits of 1 and 0 in Mobius loops and Figure-8 Klein bottles (I like to consider these things parts in what I call "digital string theory") could produce more and more space-time, thus accelerating expansion. "Produce" isn't exactly the right word since the Law of Conservation says neither matter nor energy (nor space-time) can be created or destroyed. More space-time must result from "recycling" (changing of the pattern of 1's and 0's from some other configuration: maybe it was converted from some matter or energy).

## **Mathematicians, physicists and Richard Feynman**

Also from the paper you sent - "Cosmologists sometimes state that the universe used to be the size of a grapefruit, but what they mean is that the part of the universe we can now see--our observable universe--used to be the size of a grapefruit." I wonder if "our observable universe" can be considered one of the subuniverses I'm so fond of. As my previous reply - and the above paragraph - noted, a Figure-8 Klein bottle is a subuniverse, too. And I still think the only way the space-time of an infinite universe can include expansion is for it to be made up of the space-time of an infinite number of expanding and colliding subuniverses. No doubt mathematics can find another explanation, but I don't think an over-reliance on maths properly describes reality. Mathematicians are free to imagine anything while physicists work in a very different environment and are constrained by experiment (Richard Feynman said physicists work in a straitjacket – see the video "[Hidden Dimensions: Exploring Hyperspace](http://worldsciencefestival.com/videos/hidden_dimensions_exploring_hyperspace)" ([http://worldsciencefestival.com/videos/hidden\\_dimensions\\_exploring\\_hyperspace](http://worldsciencefestival.com/videos/hidden_dimensions_exploring_hyperspace))).

I think the Scientific American article took a shortcut and didn't explain things completely when it said "As the photons travel through expanding space, they lose energy and their temperature decreases." I think the journey through space gives them more energy and increases their temperature.^ However, this energy and temperature is lost by the stretching of space - the longer wavelengths which stretching gives the radiation means photon energy is greatly reduced and the universe cools<sup>12</sup>.

^ 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 ( $126 \pm 0.4$  GeV/c<sup>2</sup>, 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).

## PPS

<sup>9</sup> To exhibit Bose–Einstein condensation, the fermions (particles of matter) must "pair up" (not in the normal manner of sharing electrons) to form compound particles that are bosons. This "pairing-up" may be achieved by using e-infinity to delete distance. This leads to a photon (such as from the Sun) experiencing the whole universe – including BECs, gravitons, and other photons - in its existence. There is no space, no time, no gravity – only one photon which occupies no physical space because it's a mathematical construction.

<sup>10</sup> This is because nearly all of gravitation's energy goes into the "organized energy" forming a particle, which then re-emits some of that energy at reduced electromagnetic frequencies, including those of gamma radiation.

## Human involvement in the retrocausality of gravity, electromagnetism and matter

<sup>11</sup> At this point, the progression is from **a) gravity to electromagnetism to matter**. Yet the end of the abstract progresses from **b) gravity to matter to electromagnetism**, and also speaks of **c) electromagnetism to gravity to matter**. G-EM-M or G-M-EM or EM-G-M? Surely there's contradiction and paradox in these statements? No. As the abstract states, this is a result of a feedback loop ... retrocausality, as quantum entanglement is called when applied not to space but to time. This retrocausality is accomplished by means of

humans travelling into the past of this subuniverse and applying the electronics they've developed to the period existing 13.8 billion years ago. Addressing **a)**, **gravity and electromagnetism combined to form the matter** composing these people, whose ancestors developed the electricity and magnetism in computers. Addressing **c)**, **this electromagnetism created gravity** (by using BITS to copy the principle of magnetism attracting and repelling, before pasting that principle into gravity – the basic physical source of all attraction and repulsion, and thus of the strong force and dark energy); **and their interaction formed matter** (could the unified gravitational and electromagnetic fields be the mass-producing Higgs field?). Addressing **b)**, **the gravity originating humanity's matter** was responsible for that matter emitting **electromagnetism**. Maybe hidden variables called binary digits (binary digits would be the hidden variables which Einstein said carry extra information about the world of quantum mechanics ... and complete it, eliminating probabilities and bringing about exact predictions) 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.

## **Interstellar and Intergalactic Travel**

<sup>11.0</sup> Here's a proposed method for making time travel to the past practical – In July 2009, electrical engineer Hong Tang and his team at Yale University in the USA demonstrated that, on silicon chip-and transistor-scales, light can attract and repel itself like electric charges/magnets. This is the "optical force", a phenomenon that theorists first predicted in 2005 (this time delay is rather confusing since James Clerk Maxwell showed that light is an electromagnetic disturbance approx. 150 years ago). In the event of the universe having an underlying electronic foundation, it would be composed of "silicon chip-and transistor-scales" and the Optical Force would not be restricted to microscopic scales but could operate universally. Tang proposes that the optical force could be exploited in telecommunications. For example, switches based on the optical force could be used to speed up the routing of light signals in fibre-optic cables, and optical oscillators could improve cell phone signal processing.

From 1929 until his death in 1955, Einstein worked on his Unified Field Theory with the aim of uniting electromagnetism (light is one form of this) and gravitation. Achievement of this means warps of space (gravity, according to General Relativity) between spaceships/stars could mimic the Optical Effect and could be attracted together, thereby eliminating distance

(similar to traversing a wormhole between two folds in space). And "warp drive" would not only come to life in future science/technology ... it would be improved tremendously; even allowing literally instant travel to points many, many billions of light years away. This reminds me of the 1994 proposal by Mexican physicist Miguel Alcubierre of a method of stretching space in a wave which would in theory cause the fabric of space ahead of a spacecraft to contract and the space behind it to expand - Alcubierre, Miguel (1994). "The warp drive: hyper-fast travel within general relativity". *Classical and Quantum Gravity* 11 (5): L73–L77. Therefore, the ship would be carried along in a warp bubble like a person being transported on an escalator, reaching its destination faster than a light beam restricted to travelling outside the warp bubble. There are no practical known methods to warp space – however, my extension of the Yale demonstration in electrical engineering may provide one.

## **Nonsupernatural God**

<sup>11.1</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 digiT S 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.

## **5<sup>th</sup> dimensional hyperspace**

# 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).

## **Dark Matter**

<sup>12</sup> When photons of visible light are travelling through space, they'd also gain energy from space-time which is inherently energetic. To be precise, they gain energy from the 1's and 0's in the vacuum which are usually labelled “virtual particles”. The concept of virtual particles is closely related to the idea of quantum fluctuations (a quantum fluctuation is the temporary change in the amount of energy at a point in space). The production of space by BITS (Binary digITS) necessarily means there is a change in the amount of energy at a certain point, and the word “temporary” refers to what we know as motion or time. Time would be like a movie composed of rapid succession of “frames” drawn by BITS – as p.14 says, “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.” Vacuum energy is the zero-point energy (lowest possible energy that a system may have) of all the fields (e.g. electromagnetic) in space, and is an underlying background energy that exists in space even when the space is devoid of matter. Binary digits might be substituted for the terms zero-point energy (since BITS are the ground state or lowest possible energy level) and vacuum energy (because BITS are the underlying background energy of empty space). Relativistically, space can't be mentioned without also mentioning time which can therefore also be viewed as gravitation (since “dark matter” is invisible but has gravitational influence, its existence could be achieved by ordinary matter travelling through time).

## **Variable Speed of Light**

This increase in energy of the light photons is balanced by the stretching of space, which causes decrease of energy (as of 21 March 2013, the Hubble constant, as measured by the Planck Mission, is  $67.80 \pm 0.77$  km/s/Mpc – “Planck Mission Brings Universe Into Sharp Focus” - <http://www.jpl.nasa.gov/news/news.php?release=2013-109&m=news.xml&rst=3739>). Thus, the speed of light in a vacuum is a constant. Energy from “virtual particles” is gained at a constant rate, while energy lost by expanding space stretching wavelengths is increasing due to space's accelerating expansion. If this acceleration continues, visible light will lose more and more energy, and its photons will slow down and even stop. This recalls the Variable Speed of Light theories – Albert Einstein in 1911, Robert Dicke in 1957,

Jean-Pierre Petit in 1988, John Moffat in 1992, and the two-man team of Andreas Albrecht and João Magueijo in 1998.

### **Trillions of millennia in the distant future**

It was necessary for the early universe to undergo inflation (extremely rapid expansion by a factor of at least  $10^{78}$  in volume, lasting from  $10^{-36}$  to approx.  $10^{-32}$  of a second after the big bang - recent cosmology text books with extensive discussions of inflation are by Liddle and Lyth (2000), Mukhanov (2005), Kolb and Turner (1988), Linde (1990), Peebles (1993), Lyth and Riotto (1999), Linde (2012), Guth (1997) and Hawking (1998). This rapid expansion converted short wavelengths (such as gamma rays produced in the big bang) into longer-wavelengths (like visible light). Eventually, this subuniverse will increase its size another  $10^{78}$  times. Then the curving lines of waves will be stretched flat and light's photons will stop, possessing no energy at all. But this subuniverse will have dispersed into, and mingled with, many other subuniverses by then (it'll be dispersed into WMAP's infinite, flat universe). Maybe we'll rejuvenate it with another big bang many trillions of millennia before this happens. Maybe we'll go live in some other subuniverse and let this one disperse. Perhaps, in this distant future, we can all have an immaterial body designed in the far future to overcome physical limitations (and that body might be quantum entangled with all space and time). Either way, life goes on.