New Way of Developing Information Technology and Imaginary Time for the Purpose of Building the Universe

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Abstract –
Stephen Hawking writes, "In real time, the universe has a beginning and an end at singularities that form a boundary to space-time and at which the laws of science break down. But in imaginary time, there are no singularities or boundaries. So maybe what we call imaginary time is really more basic …" ("A Brief History of Time" by Stephen Hawking - Bantam Press, 1988, p.139)

When Hawking says there are no singularities in imaginary time, can his statement relate to physics? Or is it purely mathematical, in which case it would reinforce the idea that the universe began with a singularity and a Big Bang? I believe imaginary time has physical meaning since it can be developed from space-time where parallel lines become perpendicular without any motion occurring. Such a feat depends on a particular form of General Relativity's space-time curvature. It leads to new cosmology and quantum physics that includes deletion of distance on every scale – plus a method for cosmogenesis or creation of the universe.

This author has a habit of "text recycling" or "self plagiarism". I've done it in the past to present an idea in different contexts, hoping that would demonstrate the idea's validity. In this article, sentences are added to my recycling – showing that I still believe in the basic idea I started with, but adding information (sometimes from mathematics) to support that basis.

Content -

PART 1 -

The space we live in is described by ordinary [or "real"] numbers which, when multiplied by themselves, result in positive numbers e.g. 2x2=4, and -2 x-2 also equals 4. Inverted (modelled on the Mobius loop) positive space 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. Space exists in an indissoluble union with time known as space-time. So imaginary numbers were naturally also applied to time, creating an entity called imaginary time. Imaginary time is a concept derived from special relativity and quantum mechanics. Physicists use a mathematical technique called Wick rotation - named after Italian theoretical physicist Gian Carlo Wick (1909-1992) – to transfer solutions from the 2 dimensional planes and 3 dimensional geometry of Euclidean space to the 4 dimensions (3 of space, 1 of time) of Minkowski space.

Geometrically, imaginary numbers are found on the vertical axis of the Complex Number Plane, allowing them to be presented perpendicular to the real axis. One way of viewing imaginary numbers is to consider a standard number line, positively increasing in magnitude to the right, and negatively increasing in magnitude to the left. At 0 on this x-axis (the so-called 'real' axis), a y-axis (the so-called imaginary axis) can be drawn with "positive" direction going up - "positive" imaginary numbers then increase in magnitude upwards, and "negative" imaginary numbers increase in magnitude downwards.

This has an interesting effect on space-time: the distinction between time and space disappears completely." ("A Brief History of Time" by Stephen Hawking - Bantam Press, 1988, p.134) Though I first heard of imaginary time from "A Brief History of Time" (and was, over the next two decades, repeatedly drawn to my dictionary's definition of imaginary numbers), I didn't know any more about the subjects until very recent years. I was forced to work out things for myself through reading and thinking – something anybody could do with enough curiosity and stubborn persistence (and plenty of time). I started by being fascinated with the Mobius strip, and progressed to the ideas on accessing hyperspace (in **PART 2**) and deleting distance (**PART 4**). A few years after that, I put these together with hyperspace's partner (hypertime) and realized I had stumbled on a way to enter imaginary time.

PART 2

LOCALIZED UNIFIED FIELD

Instantly travelling to a planet 700 light years away and instantaneously arriving at a spot in the future which a light beam could only reach by travelling for 7 centuries can be likened to a wave which spreads out from the point of departure. This is because of quantum mechanics' wave-particle duality which can view the spaceship not as a collection of particles but as a wave, or collection of waves.

shape of waves when viewed from the centres
where they begin spreading out is
CONVEX
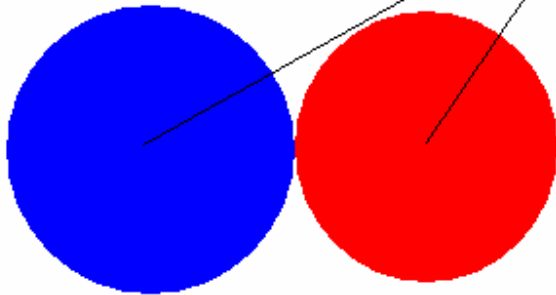
shape of waves when viewed from the planet
where they collide is
CONCAVE

At the destination, the convex shape of the spreading wave arrives instantly (meaning the ship and planet are quantum entangled). This situation is equivalent to space being translated (shifted) by 90 degrees so that the ship is perpendicular to length, width and height simultaneously. What if the spaceship is simultaneously quantum entangled with another wave arriving at the planet from "the other side of the universe"? (in the infinite universe proposed in this article, "the other side of the universe" must really mean far, far away – and when distance is eliminated in space-time, "far, far away" must mean "here and now") Since the waves are entangled and unified, their motions are instant and this situation is equivalent to space being translated by 180 degrees. It's inverted and becomes 5th-dimensional hyperspace.

THE MATRIX AND THE FIGURE-8 KLEIN BOTTLE
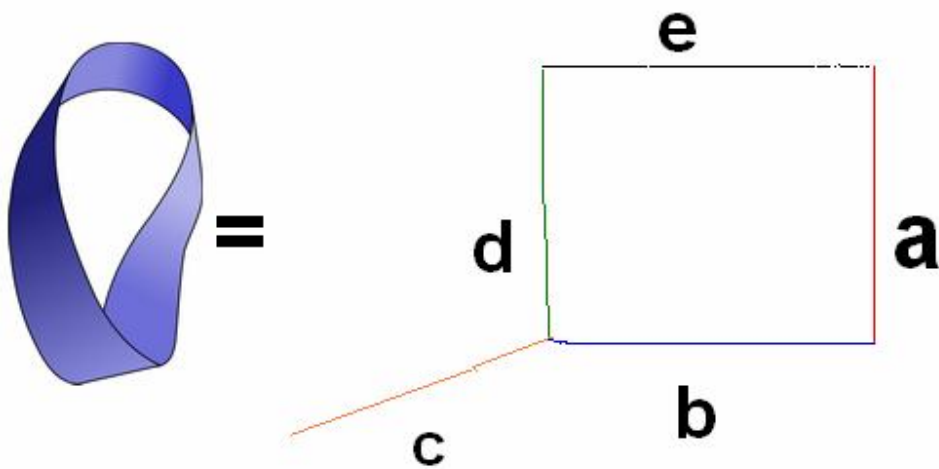
Width a is perpendicular to the length (b or e) which is perpendicular to height c. How can a line be drawn perpendicular to c without retracing b's path? By positioning it at d, which is then parallel to (or, it could be said, at 180 degrees to) a. d (the spaceship) is already at 90 degrees to length b and height c. To be at right angles to length, width and height simultaneously; it has to also be perpendicular to (not parallel to) a. This is accomplished by a twist, like on the right side of the Mobius loop pictured above, existing in a. Then part of a is indeed at 180 degrees to d, but part of a is at 90 degrees to d. This situation requires a little flexibility or "fuzziness" which allows the numbers to deviate slightly from their precise values of 90 and 180. The fuzziness is represented in nature by past, present, future, space, time, and hyperspace existing everywhere rather than being confined to particular locations. Thus, 90+90 (the degrees between b & c added to the degrees between c & d) can equal 180, making a & d parallel. But 90+90 can also equal 90, making a & d perpendicular. (Saying 90+90=90 sounds ridiculous but it has similarities to the Matrix [of mathematics, not the action-science fiction movie] which is an array of numbers placed in rows and columns. It was worked out in the mid- nineteenth century by British mathematician Arthur Cayley, matrix mechanics is a version of quantum mechanics discovered by Werner Heisenberg in 1925, and matrices say X multiplied by Y does not always equal Y times X. In this paragraph, the first 90 plus the second 90 does not always equal the second 90 plus the first 90 because 90+90 can equal either 180 or 90.) If the infinite universe is composed of subuniverses shaped like figure-8 Klein bottles (diagram at end of paragraph - 2 Mobius loops are joined on their sides to form Bottle, with binary digits filling in the central hole and perfectly adjusting the outer edges to fit surrounding subuniverses [simplified, this is similar to manipulation of an image on a

computer screen]), in each subuniverse there would be 2 perpendicularities to the twist (one lot of 90+90, then another 90+90). 180+180 could equal 360 – represented in physics as a subuniverse, a galaxy, or one of the spherical waves above producing quantum entanglement and translating space by 90 degrees. 180+180 could also equal 180 – represented in physics by both of the above spherical waves interacting to produce inversion (translation by 180 degrees) of space which permits the spaceship to enter hyperspace. Since a fuzzily spherical figure-8 Klein bottle is necessary to form (90+90) + (90+90), any spherical or fuzzily spherical thing in this fractal universe (subuniverse, galaxy, black hole, asteroid, subatomic particle, or anything made of either fermions or bosons) would be an example of altered or warped space-time and must include hyperspace in its composition.
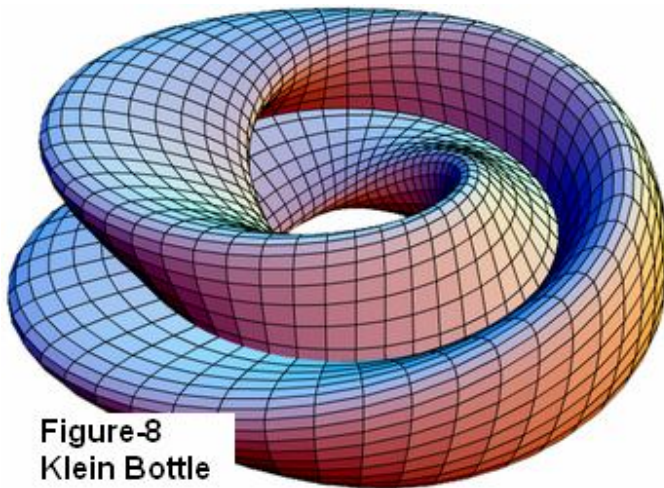
Figure-8
Klein Bottle

For the note below on the figure-8 Klein bottle, I refer to –

a) Bourbaki, Nicolas (2005). *Lie Groups and Lie Algebras*. Springer
b) Conway, John (1986). *Functions of One Complex Variable I*. Springer
c) Gamelin, Theodore (January 2001). *Complex Analysis*. Springer
d) Joshi, Kapli (August 1983). *Introduction to General Topology*. New Age Publishers
e) Spanier, Edwin (December 1994). *Algebraic Topology*. Springer

Informally - if an object in space consists of one piece and does not have any "holes" that pass all the way through it, it is called simply-connected. A doughnut (and the figure-8 Klein bottle it resembles) is "holey" and not simply connected (it's multiply connected). The universe appears to be infinite, being flat on the largest scales and curved on local scales (from far away, a scene on Earth can appear flat, yet the curves of hills become apparent up close). A flat universe that is also simply connected implies an infinite universe (Luminet, Jean-Pierre; Lachi`eze-Rey, Marc - "Cosmic Topology" - Physics Reports 254 (3): 135–214 (1995) arXiv:gr-qc/9605010). So it seems the infinite universe cannot be

composed of subunits called figure-8 Klein bottles (flat universes that are finite in extent include the torus and Klein bottle). But gaps in, or irregularities between, subuniverses shaped like figure-8 Klein bottles are "filled in" by binary digits in the same way that computer drawings can extrapolate a small patch of blue sky to make a sky that's blue from horizon to horizon. This makes space-time relatively smooth and continuous - and gets rid of holes, making Klein subunits feasible. The Klein bottle is a closed surface with no distinction between inside and outside (there cannot be other universes, a multiverse, outside ours – there's only one universe).

The spherical waves illustrated above (representing a spaceship's wave-particle duality) could act as carrier waves for binary digits which would encode certain information within them.

DIGITAL STRING THEORY

String theory says everything's composed of tiny, one-dimensional strings that vibrate as clockwise, standing, and counterclockwise currents. [Time-Life Books - "Workings of the Universe" – 1991, p.84] We can visualize tiny, one dimensional binary digits of 1 and 0 (base 2 mathematics) forming currents in a two-dimensional program called 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.

Joining two Mobius strips (or Mobius bands) forms a four-dimensional Klein bottle [K. Polthier - "Imaging maths - Inside the Klein bottle" (http://plus.maths.org/content/os/issue26/features/mathart/index]. And each Klein bottle can become an observable (or "sub") universe (figure-8 Klein bottles appear to have the most suitable shape to form subuniverses). This connection of the 2 Mobius strips can be made with the infinitely-long irrational and transcendental numbers (see **CONNECTING DIGITS INTO THE MOBIUS THEN THE KLEIN**). Such an infinite connection translates^ into an infinite number of figure-8 Klein bottles which are, in fact, "subuniverses". The infinite numbers make the cosmos as a whole* physically infinite, the union of space and time makes it eternal, and it's in a static or steady state because it's already infinite.

* (i.e. the cosmos beyond our 13.8-billion-year-old subuniverse, which is expanding and displacing parts of the universe beyond)

^ The translation could be via photons and gravitons being ultimately composed of the binary digits of 1 and 0 encoding pi, e, √2 etc.; and matter particles [and even bosons like the Higgs, W and Z particles] being given mass by photons/gravitons interacting in matter particles' "wave packets".
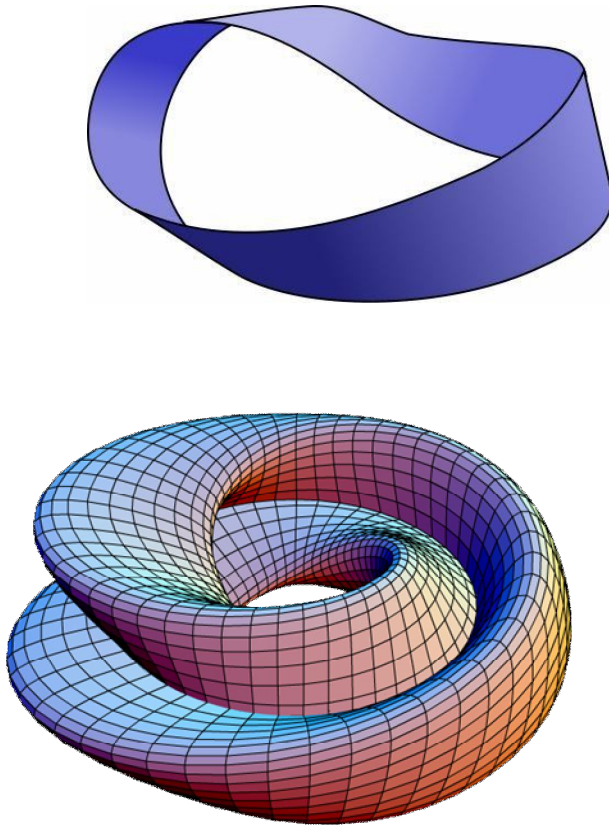
Mobius Loop

Figure-8 Klein Bottle

CONNECTING DIGITS INTO THE MOBIUS THEN THE KLEIN

Here are a few thoughts concerning cosmogenesis –

Mobius loop**:** This is how it might be used in building a universe - We write down everything our species has learned (an "Encyclopedia Universalis"). Instead of using ink, we use the binary digits of 1 and 0. And we do not write on paper or in computers in a linear fashion (one line after the other … left to right, top of page to bottom). We "write" in the warps of space-time and hyperspace and do so in Mobius fashion (everything is written so that it's comparable to being on a piece of paper that's given a half-twist of 180 degrees before the ends are joined). This causes curving and warping in space-time, confusion of "here" and "there" (quantum entanglement), and muddled causes and effects (retro- or backward causality). Because of this entanglement of all time and space; if the writing is done in the year 3,000 it might possibly still include the knowledge of the year 3,000,000 or 3,000,000,000 and so on.

Two Mobius strips are "written" (one with a clockwise flow of binary digits, one with counterclockwise). We'll use pi as an example of all the infinite numbers. When anything is added to or multiplied by pi, it also becomes infinite. 1 + pi

never ends, a Mobius strip + pi never ends. Encoding pi into both strips causes them to merge since they never end but continue into each other. Upon merging, they create a Klein bottle which, by definition, is the product of two Mobius strips. Since the strips are infinite, either one infinitely large bottle or an infinite number of relatively small bottles must form.

(The Mobius strips are intangible software. They're converted into the tangible Klein bottles which make up the universe via matter being given mass by photons of electromagnetic waves and the gravitons of gravitational waves interacting in matter particles' "wave packets", giving the matter wave-particle duality. The bottles are thus 3-dimensional and affect all our senses. When future electronics allows their displays to change from one still (as in photographic print) to another trillions of trillions of trillions of times per second, they are undergoing what we call motion or time and are 4-dimensional.^ The beginnings of the infinite number of observable universes would, of course, be literally infinite. There was no beginning to the universe as a whole but it had - and will continue to have - an infinite number of creations of its "sub"universes. Creation of the universe as a whole is therefore forever lost in infinity and it's accurate to say it had no beginning. German mathematician Georg Cantor developed concepts of various infinities in the 1870's, and would be interested in the last few paragraphs.)

^ Were ancient Greek philosophers Zeno of Elea and Parmenides at least partly correct to speak of the absurdity of reality being made up of many changing things? Zeno also said motion is absurd. Motion and change would, in the end, merely be the switching of 1's to 0's and vice versa. There wouldn't even be any switching motion on the digital level if distance is eliminated and only quantum-superposed qubits exist. See the first paragraphs in **PART 4**.

"Hidden variables is an interpretation of quantum mechanics based on the belief that the theory is incomplete and that there is an underlying layer of reality that contains additional information about the quantum world. The identification of these hidden variables would lead to exact predictions for the outcome of experiments and not just probabilities of obtaining certain results." [Kumar, M. – "Quantum" – Icon Books, p.379 (2008)]. Virtual particles (which are not particles at all but disturbances in a field, and located in subatomic reactions as well as space) are identified as hidden variables called bits (Binary digITS) in order to produce the exact outcomes necessary to build anything – in this case, the universe.

In the core of stars the size of the Sun, or smaller, energy is released through sequences of nuclear reactions that convert hydrogen into helium. The primary reaction is thought to be the fusion of two protons, with the emission of a low-energy neutrino as one proton changes into a neutron. The mass of the proton is 938.27 MeV/c^2 while the neutron is 939.57 MeV/c^2. How does a proton transform into a more massive neutron by radiating detectable particles? Since it is known that absorption of particles doesn't take place, there must also be

radiation of undetected entities. Scientists call these virtual particles. If space-time is composed of 1's and 0's (the bits used in electronics), neutrons absorb these virtual particles directly from their environment. This absorption destabilizes the balance between forces in the atomic nucleus and can lead to an atom of radioactive uranium-235 which possesses 92 protons and, thanks to mass increase via absorption of the energy of bits, 143 neutrons.

Similarly, the virtual particles called bits introduce instability into the Klein bottles forming the universe because they're continually encoding pi's infinity of decimal places. The cosmos can never be at rest and its instability results in everything out of the ordinary - supernovas, earthquakes, bone cancer in children, bad hair days … Just as quantum unstableness results in the U-235 nucleus possessing 143 neutrons, the instability in Klein bottles – the bottles are infinite because they're formed from infinite Mobius strips that have pi etc encoded into them - produces not one infinitely large Klein but an infinite number of smaller ones. This is an example of scale invariance – the law that many, and not one, are produced is independent of scale (subatomic neutron and cosmic Klein bottle, in this case).

PART 3 –

Since the time associated with the 3 dimensions of up-down, back-front and side-to-side is often called the 4th dimension, should negative time in a 5th dimensional hyperspace be called the 6th dimension of hypertime? Here are some scientists who support the idea of an extra time and an extra space –

a)"There isn't just one dimension of time," Itzhak Bars of the University of Southern California in Los Angeles tells New Scientist. "There are two. One whole dimension of time and another of space have until now gone entirely unnoticed by us."
("Are we missing a dimension of time?" By Roger Highfield 10 Oct 2007
http://www.telegraph.co.uk/news/science/large-hadron-collider/3309999/Are-we-missing-a-dimension-of-time.html)

b) "One daring physicist - Cumrun Vafa from Harvard - has discovered that an extra time dimension could solve more problems than it creates." In "Here comes hypertime - Want to sidestep your future or rearrange your past? An extra time dimension could be all you need, says Gabrielle Walker, and it might even be the key to the theory of everything" by Gabrielle Walker – November 1, 1997
(http://www.newscientist.com/article/mg15621065.000-here-comes-hypertime--want-to-sidestep-your-future-or-rearrange-your-past-an-extra-time-dimension-could-be-all-you-need-says-gabrielle-walker-and-it-might-even-be-the-key-to-the-theory-of-everything.html)

ARE HYPERTIME AND IMAGINARY TIME THE SAME THING?

Measuring time using imaginary numbers, and thus creating **imaginary time**, has an interesting effect on space-time: the distinction between time and space disappears completely." ["A Brief History of Time" by Stephen Hawking (Bantam Press, 1988, p.134)] A negative 5th-dimension is described by imaginary numbers so imaginary numbers eliminate distinctions between space-time and the 5th dimension, permitting hyperspace to exist in the same place as space-time (like the other side of a space-time coin) and also permitting dark matter (the particles existing in hyperspace) to co-exist with "ordinary" matter.

At first, it seems that the two times in the heading are different because hyperspace (and hypertime) inverts 180 degrees while imaginary time is at 90 degrees to "real" time. However, **The Matrix and the Figure-8 Klein Bottle** upsets recognized maths by saying 90+90=180 and 90+90=90 (by looking at the second equation, 90=180). Therefore, hyperspace (and hypertime, since they'd form a union like space-time) may be said to invert 90 degrees and hypertime is at 90 degrees to "real" time.

So the property within hyperspace that's called 6-D hypertime is identical to imaginary time.

PART 4 –

The Optical Force and E=mc^2

A 2009 electrical-engineering experiment at America's Yale University, together with the ideas of Albert Einstein, tells us how we could travel to other stars and galaxies in literally no time. Electrical engineer Hong Tang and his team at Yale demonstrated that, on silicon-chip and transistor scales, light can attract and repel itself like electric charges or magnets ["Tunable bipolar optical interactions between guided lightwaves" by Mo Li, W. H. P. Pernice & H. X. Tang - Nature Photonics 3, 464 - 468 (2009)]. This is the "optical force". For 30 years 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^ – also see **Digital String Theory** - means the microscopic components (gravitons) of warps of space (gravity, according to General Relativity) between spaceships and stars could mimic the Optical Effect and be attracted together, thereby totally eliminating distance (this is similar to traversing a wormhole, or shortcut, between two folds in space-time). Distance is not only deleted in space. There would no longer be any "distance" in time. Just as we can journey to particular stars, we could take trips to particular years in the past (using hyperspace) or future (using space-time). Instantly traversing 700 light years in space enables a spaceship to arrive at a spot which a light beam could only reach by travelling for 7 centuries, putting the ship 7 centuries in the future. Entering hyperspace with its negatives (energy, matter, distance, time) permits travel to the past since it would be impossible to travel 700 lightyears there, and only possible to travel minus 700 lightyears. Doing so instantly would enable a

spaceship to arrive at a spot in the past which a light beam could only reach by traversing negative distance for 7 centuries. Though negative distance or time is totally alien to us, it must exist as surely as positive distance or time if the universe is mathematical.

^ Deleting internal distance between 1's and 0's permits the bits (binary digits) to become the qubits of quantum computers
[University of Bristol > School of Physics > Simulator
(http://www.bristol.ac.uk/physics/research/quantum/qcloud/simulator/)]
which exist as both a 0 and 1 simultaneously i.e. in "quantum superposition". This appears to support the idea of the mathematical universe operating via maths' base 2 system (the binary digits of 1 and 0). If the cosmos is made of 1's and 0's, the implication is that human intelligence is nothing more than AI or artificial intelligence. It's only our egos that make us believe our minds are somehow fundamentally different from the computers we use (or more than an advanced form of the AI responsible for photosynthesis in plants).

The subject of imaginary time is being discussed, and space-time is a unity that's united with another unity called hyperspace-hypertime. So in preference to saying warps of space are attracted together to eliminate distance, the focus can be placed on the temporal aspect - and we travel at 90 degrees to time as it's known. Movement forwards through hypertime is always in the "up" direction and, whether the trip is a relatively short one to Mars or one of countless billions of light years, absolutely no motion occurs in ordinary time's horizontal direction (Relativity's time dilation ^ implies time might be stopped, making travel instant). And the journey is thus instant (the horizontal axis of time can be visualized as flat space, while the vertical axis of imaginary or hyper-time would correspond to warps in space being attracted together and resembling vertical ocean waves).

^ Special Relativity shows that time slows down for anything moving, but this is only noticeable at significant fractions of the speed of light.

So we can produce the effect of faster-than-light travel for both matter and information, without engaging in actual faster-than-light travel (that is impossible).

The inverse-square law states that the force between two particles becomes infinite if the distance of separation between them goes to zero. The distance of separation only goes to zero when those particles' 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, both in space and time. The infinite cosmos could possess this absence of distance in space and time via the electronic mechanism of binary digits (making it as malleable as any image on a computer screen).

Referring to E=mc^2, we can change the relationship between m and c^2 from multiplication to equality i.e. in popular teaching, m is multiplied by c^2 but m = c^2 in this circumstance. Representing the masslessness of photons by 0 (zero)

and replacing the m (mass in Einstein's famous equation relating energy, mass and the speed of light) with the masslessness results in $E=0*c^2$ i.e. $E=0$. Having reduced the equation to nothing but E, $m=0$ and $c^2=0$ which means $m=c^2$. At first glance, $m=c^2$ seems to be saying mass exists at light speed. But the absence of E refers to there being no interaction of light energy and gravitational energy, and therefore no mass (see **Digital String Theory**). If mass cannot be produced, there must be no space-time/gravity and space=0, time=0 and gravity=0.* The zeroness of space-time/gravity does not mean it doesn't exist. It means we can appear to re-locate matter and information superluminally, or travel into the past and future, because distance is eliminated in both space and time by attracting together the folds in space-time that are called gravity.

* The zeroness of time might mean this - the basic standard of time in the universe is comparable to the 1960's adoption on Earth of the measurement of time as the vibration rate of cesium atoms. We could borrow the conclusions of Albert Einstein's Special Relativity and set the standard for time measurement as the measuring of the motions of photons i.e. of the speed of light. At lightspeed, time = 0 (it is stopped). Below 300,000 km/sec, acceleration or gravitation causes time dilation (slowing of time as the speed of light is approached).

From Einstein's formula, $c^2=E/m$ and (using $m=c^2$) $c^2=E/c^2$ which means $E=c^4$. c^2 and the Atom states that graviton/photon interaction produces mass (both particles are equally vital), so E (mass-energy of particle) = c^2 (light's photon) multiplied by c^2 (gravity's graviton) ($c^2*c^2=c^4$). The speed of light is c and c^2 refers to observers and light co-moving. Einstein repetitively stressed that his mass-energy equation is strictly limited to observers co-moving with the object under study (I think he was referring to the time in the 1890s when he was imagining what it would be like to move along beside a beam of light). So the other c^2 refers to observers and gravity co-moving. The speed of gravitational waves is c and the speed of light is equal to the speed of gravity. Of course, this ignores quantum entanglement – this implies that if the sun suddenly stopped shining or having a gravitational influence, those effects would be detectable instantly (as Isaac Newton believed).

PART 5 -

Information technology and imaginary time have now been approached and developed in new ways, and a plan for going back in time before our local universe existed and bringing it into being has been proposed. It remains to be seen what all this has to say about cosmology, biology and quantum physics. To do that, I offer links to the last four articles I've written at http://vixra.org/author/rodney_bartlett -

1) "What Is Consciousness?" - http://vixra.org/pdf/1502.0129v2.pdf

2) "Dark Matter Related To Warps, The Unified Field, Quantum Spin And Dark Energy" - http://vixra.org/pdf/1503.0084v1.pdf

3) "New Hypothesis About Proton-Proton Reaction" - http://vixra.org/pdf/1503.0144v2.pdf

4) "The Gravito-Electromagnetic Force" - http://vixra.org/pdf/1503.0157v1.pdf

Introduction to those 4 articles –

To begin this section on cosmology, here's a brief overview of how I view the construction of the universe – The background for this article is a hypothesis for origins (of life, the universe and everything). That hypothesis believes human science is responsible for everything, and neither supernatural nor evolutionary means originate anything. In a biological sense, the Theory of Evolution certainly explains adaptations and modifications. But believing it also explains origins is unwarranted extrapolation. It takes an idea that accounts for some parts of life and, since it's the only scientific explanation we currently have, assumes it accounts for all parts of life.

Albert Einstein showed space-time is warped, so it's possible our own computer science (and terraforming, and biotechnology from many centuries in the future) found its way into the past. Dr Graham Phillips said "(The physicist) Paul Davies thinks the universe is indeed fine-tuned for minds like ours. And who fine-tuned it? Not God, but minds from the future, perhaps even our distant descendants, that have reached back through time … and selected the very laws of physics that allow for the existence of minds in the first place." [Australian Broadcasting Corporation's TV program "Catalyst" - "Custom Universe – Finetuned For Us?" – August 29 2013]