

## Letter To UNDIVIDED LOOKING – COMMENTS ON PHYSICS AND THEOLOGY

Author – Rodney Bartlett

Abstract -

This is what you get when you Google "imaginary time" and stumble across a Christian website by a postdoctoral researcher studying quantum gravity and black hole thermodynamics. The site is called UNDIVIDED LOOKING – COMMENTS ON PHYSICS AND THEOLOGY, and the page I first found is at <http://www.wall.org/~aron/blog/did-the-universe-begin-viii-the-no-boundary-proposal/>.

The website owner's comment policy advises readers "Do not simply copy and paste a large amount of text ..." which almost made me decide not to comment. But I finally did. Even though I have copied and pasted parts inbetween parts written today, I think the choosing of the widely separated lines of pasted text makes this what he calls "an individualized response". Anyway, my comment seems to have been eaten by a black hole. Instead of letting half a day of work go to waste, I'll post my thoughts here.

Content -

### IMAGINARY TIME AND THE COMPLEX NUMBER PLANE

Historically, mathematics often later finds practical application in physics. The idea of the quantum was originally developed by Max Planck purely as a mathematical convenience, but it's been part of our reality for nearly a century. So the Complex Number Plane might find applications undreamt of today. One direction along the horizontal axis corresponds to going forwards in time and is called "real". The reverse direction along the horizontal axis corresponds to going backwards in time and is called "complex". The vertical axis represents the "imaginary time" described by the imaginary numbers of physics. The terms real, imaginary and complex come from the corresponding numbers in maths. "Physics of the Impossible" by Michio Kaku (Penguin Books, 2009) states on pp. 276-277,

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

Suppose Einstein was correct about gravitational fields restating Maxwell's equations in terms of gravity. Then gravitational waves would also have an "advanced" solution. Retarded gravitational and electromagnetic waves correspond to the forwards motion of real time on the horizontal axis, and advanced waves correspond to the backwards motion of complex time on the horizontal axis.

## GRAVITATIONAL-ELECTROMAGNETIC UNIFICATION AND BLACK HOLES

The warps in space and time are gravity, so the vertical axis of imaginary time represents one of the cardinal directions which gravitational waves can travel. The 2012 article "How Einstein Discovered Dark Energy" by Alex Harvey (<http://arxiv.org/pdf/1211.6338v1.pdf>) states,

"Recall that in 1918 the only elementary particles known were the electron and the proton. Physicists were attempting to understand why these were stable despite their internal electromagnetic repulsion. Most attempts were based solely on electromagnetic theory."

In 1919, Einstein submitted a paper to the Prussian Academy of Sciences asking "Do gravitational fields play an essential role in the structure of elementary particles?" ["Spielen Gravitationsfelder in Aufbau der Elementarteilchen eine Wesentliche Rolle?", *Sitzungsberichte der Preussischen Akademie der Wissenschaften, (Math. Phys.)*, 349-356 (1919) Berlin]. This attempt at gravitational-electromagnetic union, together with his restating of Maxwell's equations in terms of gravitational fields, suggests the vertical axis of imaginary time also represents one of the cardinal directions which electromagnetic waves travel. It's possible that Einstein's paper has been incorrectly judged as wrong for the last century and that gravitational fields really do play an essential role in the structure of elementary particles. If gravitational and electromagnetic waves unite in travel along the imaginary axis, and if that axis unites with our so-called real axis, there would be gravitational-electromagnetic coupling in the universe we're familiar with. If it's not just gravitation, but this coupling, that plays an essential role in the structure of elementary particles; then imaginary time would be associated with very high energies and curvatures – the high energy of combining gravity with the  $10^{36}$  times more powerful electromagnetism, and the high curvature/warping of those two forces interacting in a particle's "wave packets". Warps and curves in space and time are gravity: so if there's gravitational-electromagnetic coupling in the universe we're familiar with, it's logical that space-time warps/curves (including the warps making up matter) are gravitational-electromagnetic, and the cosmos is a union of those forces into one field.

Production of the Higgs boson by gravitational-electromagnetic coupling means that interaction could more succinctly be called "the Higgs field". This is indeed plausible since alternative versions of Higgs theory still circulate in science in which the role of the Higgs field is played by various couplings (see M. Tanabashi; M. Harada; K. Yamawaki. Nagoya 2006: "The Origin of Mass and Strong Coupling Gauge Theories". International Workshop on Strongly Coupled Gauge Theories. pp. 227–241). If the cosmos is a unified gravitational-electromagnetic field, gravity does not need to travel – the gravitational field already exists everywhere. Nevertheless, any disturbance (from the waving of your hand to explosion of a supernova) will send ripples called gravitational waves through the universe. The universe is also a giant electromagnetic field. Electromagnetism is ubiquitous and doesn't need to travel, but any disturbance sends out electromagnetic waves. In this way, photons in the giant electromagnetic field which aren't travelling because of disturbances might be regarded as "already stopped". Sometimes gravitation's hypothetical gravitons and electromagnetism's photons interact to form mass eg in the star/planet-forming higher temperatures of gas/dust clouds). Sometimes the force-carrying particles can't directly interact because of near-absolute-zero temperatures but merely remain together as the universe's gravitational-electromagnetic field, possibly forming black holes.

## POINCARÉ CONJECTURE AND HUBBLE CONSTANT

Mathematics' Poincaré conjecture has implications for the universe's shape and says you cannot transform a doughnut shape into a sphere without ripping it. This can be viewed as subuniverses, like our 13.8-billion-year-old observable universe, that are made up of Figure-8 Klein Bottles (similar in shape to doughnuts). These bottles gain rips called wormholes when extended into the spacetime that goes on forever, forming one infinite superuniverse. Consistency with the conjecture requires space-time to be spherical ie to manifest closed, positive curvature. The wormholes can penetrate through the curvature from one surface to another, and thus belong to the Complex Number Plane's higher dimensions of imaginary space-time and complex space-time. When extended infinitely, this curvature becomes flat. Space-time as we know it must also include saddle-shaped, negative curvature which extends like the pommel at a saddle's front and allows the vertical, imaginary axis of the Number Plane.

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). Imaginary time must interact with real space-time because Hawking says it makes "the distinction between time and space disappear

completely." (p.134) There could be a Big Bang if space-time existed in isolation. But if it's unified with imaginary time, there might be no singularities or boundaries, and no Big Bang.

While the metric expansion of space appeared to be implied by Edwin Hubble's 1929 observations, Hubble always disagreed with the expanding-universe interpretation of the data:

"... if redshift are not primarily due to velocity shift ... the velocity-distance relation is linear, the distribution of the nebula is uniform, there is no evidence of expansion, no trace of curvature, no restriction of the time scale ... and we find ourselves in the presence of one of the principles of nature that is still unknown to us today ... whereas, if redshifts are velocity shifts which measure the rate of expansion, the expanding models are definitely inconsistent with the observations that have been made ... expanding models are a forced interpretation of the observational results"

— "Effects of Red Shifts on the Distribution of Nebulae" by *E. Hubble, Ap. J., 84, 517, 1936*

## RE: COSMOS - MATH EXTENSION REPLACES PHYSICAL EXPANSION

If there's indeed no Big Bang and no expanding universe, alternative ideas become necessary -

String theory – the best known hypothesis of modern physics searching for the universe's Theory of Everything - says everything's composed of tiny, one-dimensional strings that vibrate as clockwise, standing, and counterclockwise currents (p. 84 of "Workings of the Universe" by Time-Life Books, 1991). We can visualize the tiny, one dimensional, so-called Virtual Particles that fill all space and are really pulses of energy. We can visualize them generating binary digits of 1 and 0 (base 2 mathematics) that form 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. (The curving of what we call space-time sounds very strange, but I think it can actually be explained by modelling space-time's construction on the Mobius strip that can be represented by giving a strip of paper a half-twist of 180 degrees before joining its ends.) Joining two Mobius strips (or Mobius bands) can form a four-dimensional figure-8 Klein bottle

(<http://plus.maths.org/content/os/issue26/features/mathart/index>). And Klein bottles can become an observable (or "sub") universe: figure-8 Klein bottles resemble spiral galaxies, and 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. Such an infinite connection translates into an infinite number of tangible figure-8 Klein bottles which are subuniverses. They're tangible because the numbers result from the virtual particles making up the universal G-EM (Gravitational-ElectroMagnetic) field (the on-off pulsing of the virtuals generates binary digits which encode numbers, some of which are infinitely-long). And the virtual gravitons also help compose matter. The infinite numbers make the cosmos as a whole (that is: the cosmos beyond our 13.8-billion-year-old subuniverse) 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.

Is it possible that the extension into space-time by mathematical topology's figure-8 Klein bottles is "one of the principles of nature that is still unknown to us today"? Extension would be a mathematical process – involving binary digits, Mobius strips, figure-8 Klein bottles, pi, imaginary time, perpendicular angles ... It would replace the similar, though definitely not identical, physical expanding-universe model which Hubble always disagreed with. The Hubble constant would not measure the rate of universal expansion, but would be a measure of how much computers of the distant future are used ie of how much extra space-time and mass are converted from the electronic output of virtual particles. Like any useful invention, the technology doubtlessly receives increased use as time passes. Output of spacetime/mass is magnified and this is known by believers in an expanding cosmos as accelerated universal expansion ("Nobel physics prize honours accelerating Universe find" by Jason Palmer - Science and technology reporter, BBC News, 4 October 2011 - <http://www.bbc.com/news/science-environment-15165371>).

Quantum mechanics suggests distance is actually an illusion: quantum entanglement links particles in space-time regardless of how many light years of space (and perhaps regardless of how many 365-day years of time) separate them. If the cosmos is made of 1's and 0's (binary digits), it would a) have AI or artificial intelligence like, but infinitely more powerful than, that of computers or androids; and b) may not be composed of separated stars, people and so on; but all space and time could be entangled in a qubit if all forms of distance are removed between virtual particles and their on-off pulsing which creates digital output. Entanglement and the qubit dispose of Cosmic Inflation's idea that the uniformity in the cosmos means particles in the universe must have once been in physical contact.

IMAGINARY TIME AND ENTANGLED SIMULATION OF COSMOS

For a possible, humanistic method of explaining how this could be a synthetic universe full of binary digits, Möbius strips, figure-8 Klein bottles, and universal Artificial Intelligence on astronomical, subatomic and biological levels; please read the following subsection: remembering that in the TV program "Custom Universe – Finetuned For Us?" (Australian Broadcasting Corporation's "Catalyst", August 29 2013), Dr. Graham Phillips reported that "the physicist and writer Paul Davies thinks the universe is indeed fine-tuned for minds like ours. And who fine-tuned it? Not God but minds from the future, perhaps even our distant descendants, that have reached back through time ... and selected the very laws of physics<sup>^</sup> that allow for the existence of minds in the first place. Sounds bizarre, but quantum physics actually allows that kind of thing."

<sup>^</sup> (as well as, this author thinks, the electronic energy pulses known as virtual particles)

(1) Create binary digits (bits) with computer energy-pulses that are divided into smaller units and call the fractionated<sup>^</sup> pulses "virtual particles". Then create mass and matter by causing the virtual particles to interact.

<sup>^</sup> Fractionation may be necessary to differentiate detectable, and presumably more energetic, "real" photons from undetectable (less energetic?) virtual photons. Consider division of matter and division of energy. Any object you look at can a) be divided into atoms and molecules; then b) subdivided into protons, neutrons and electrons; then c) the protons and neutrons of the atomic nucleus can be further subdivided into quarks. At this fundamental quark level, some words from the book "The Grand Design" are pertinent - "It is certainly possible that some alien beings ... would make the same experimental observations that we do, but describe them without quarks." [Stephen Hawking, Leonard Mlodinow – "The Grand Design" – Bantam Press, 2010, p. 49] Following the example of matter, energy like a sunbeam or gravity wave has now a) been divided into their quanta (supposedly smallest units) of the photon and still hypothetical graviton. Is it possible that the photon could b) be fractionated (subdivided) into virtual photons? Finally, all virtual particles might c) be further subdivided into electronics' bits of 1 and 0. This may be the most fundamental level, where the same experimental observations might be described with different methods eg as Hawking radiation's creation and annihilation of photons, or with the base-2 mathematics of bits.

(2) Build simulation of universe using bits, Möbius strips and figure-8 Klein bottles.

(3) Make simulation infinite and eternal by including some infinitely-long numbers like pi, which are encoded by the bits.

(4) As computer hardware and software develop, the simulated cosmos has more and more decimal places of pi built into its structure and function. Modern computers have calculated pi to over  $10^{13}$  (13 trillion, 300 billion) digits (<http://www.numberworld.org/y-cruncher>). Suppose this outputted number is fed back into the simulation as input. This gives an approximation of infinity/eternity. Repeatedly looping later calculations from output to input continuously refines the approximation, resulting in what mathematician Georg Cantor called "an infinity of infinities" over a century ago. Now suppose engineers warp space-time so the functioning of the computer's processor takes place in the so-called imaginary time spoken of in Complex Number Plane. Its calculations would be retrieved instantly after they were entered into the computer even if calculations ran for billions of years because no period at all could elapse in our "real" time, resulting in a presently unbelievably long value for pi being obtained instantaneously. Diverting the processor's working to the Number Plane's complex time means results are available at any desired point in the past. A second processor could use imaginary time to instantly calculate not closer and closer to the value of an infinite number, but to instantly "draw a line" farther and farther into the distant past. In a cosmic unification where everything is connected, warping could merge the path in imaginary time with that in complex time so the "drawn line" would be more than a calculation. It would make the infinity of the past (or at least a superb approximation of it) into reality. Bending vertical imaginary time towards horizontal "real" time instead of horizontal "complex" time translates into an infinite future.

(5) Everything in time and space is part of the same computer program, and is entangled/unified into a qubit on quantum and macroscopic scales. This puts hidden order into apparent disorder (a fundamental principle of Chaos theory).

(6) Entanglement in the simulation is unable to remain separate from the quantum-mechanical entanglement existing in our reality because imaginary time removes all boundaries between the two universes. They naturally merge, influencing each other and becoming one.

(7) What we call expansion of the universe is therefore actually extension of the simulation's bits, Mobius strips and figure-8 Klein bottles. This scenario agrees that 20th-century astronomer Edwin Hubble was correct when he never accepted the expanding-universe interpretation of his work.

(8) The poorly-named imaginary time of physics and mathematics unites with pi (both are necessary to generate a truly infinite universe) and with the simulated-real

hybridization of the universe to free it of boundaries and make it infinite. Professor Stephen Hawking says that boundaries exist in real time but don't exist in imaginary time ("A Brief History of Time). There really are boundaries in real time and it must hypothetically be possible to step outside the universe if only real time exists. But if imaginary time also exists, it is not possible to step outside the universe coz the boundaries simply aren't there and the universe never ends (neither in space nor in time).

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