Understanding Today's Science with Help from Special Relativity and General Relativity

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Abstract -

This article began to take shape in my mind when I read an item in Astronomy magazine. That item mentioned how timing by GPS (the Global Positioning System) requires input from both Special Relativity - where time slows down fractionally for the fast-moving satellites in orbit – and General Relativity, where the satellites' distance from Earth's gravity causes their time to speed up fractionally. This led to the conclusions that 1) the gravitational waves making up the gravity field are, as Einstein suggested in a paper written four years after publication of the general theory, involved in production of mass, 2) these waves participate with the other long-range force, electromagnetism, to also produce the two nuclear forces associated with the mass (making nuclear forces non-fundamental and the Higgs force another name for gravitational-electromagnetic coupling), 3) black holes are composed of gravitational and electromagnetic waves focused on them from deep space, and this accounts for their extreme gravity as well as extreme mass, 4) there's a link between the macroscopic black holes of astronomy and the subatomic gluons of particle physics, and 5) Einstein's contributions don't end with the two Relativities, or even the paper written 4 years after the general theory, but can be extended to his Unified Field Theory.

His Unified Field might not be generally accepted today because it was incomplete, just as he described quantum mechanics as incomplete. In 1957, Charles Misner and John Wheeler, in the “Annals of Physics”, claimed Albert Einstein’s latest equations demonstrated the unified field theory. However, the necessary completion of the unified field may not exclusively lie with the mathematics Einstein seemed to increasingly rely on as he aged but with concepts in computer science as well as intuitions in the mathematical branch called topology. Einstein was a Superman at exploring new ideas in his youth. Had electronic computers been invented 30 or 40 years earlier, it appears likely we’d be living with the fruits of the unified field now.

PS This article also mentions superconductivity, imaginary time, complex number plane, quark-gluon plasma, antigraviton, shape of space, dark energy, dark matter and antimatter.

Content -

TIME DILATION AND GRAVITY

Time dilation is a phenomenon of the special theory of relativity. It states that, for a stationary observer, a moving clock moves slower than a non-moving one. Clocks that are far from massive bodies (or at lower gravitational potentials) run more quickly, and clocks close to massive bodies (or at higher gravitational potentials) run more slowly. Most people assume a clock floating in space, isolated from any astronomical body, has a low gravitational potential because it's located far from the source of gravity at the centre of a planet, star or black hole. But it's feasible that the low gravitational potential results from gravitational waves converging on that centre. Out in space, gravity is low and the angle between two waves can be large. As the waves converge, the angle decreases and gravity becomes stronger (more waves occupy a given volume), reaching its greatest strength at a planet's centre where the gravitational potential is high.

As the gravitational waves become more powerful, they push on the clock's components with more and more force. This makes it harder and harder for the components to move, and time slows. Of course, the affected body doesn't have to be a clock. It can be any kind of particles - such as photons that find it increasingly difficult to continue the motion of their original path and are consequently refracted by, say, the Sun's gravitational field (the closer gravitational waves approach the Sun's centre, the more powerful is the resulting field). If the clock happens to be a watch on your wrist, you and the watch are equally affected by the waves – both are in the same frame of reference, or comoving. Observer and observed are stationary relative to each other, and your nonmoving watch does not run slower (time passes normally).

General Relativity says gravity is the curvature and warping of space-time. Since space-time exists everywhere, every part of time and of space is dependent on gravitational waves. The faster travel is, the more time dilation (slowing of time) there is. This makes sense, since there would be more contact with space-time (with gravitational waves) the faster you go – and gravity slows time. Black holes can slow time to a standstill, so a black hole could be the focus of gravitational waves from deep space. I see no logical reason to exclude any form of matter – a part of time and of space - from this arrangement of every part of time and of space being dependent on gravitational waves. I guess Albert Einstein made the same error (science in 2016 calls it an error, anyway) since he published a paper called “Spielen Gravitationfelder in Aufbau der Elementarteilchen eine Wesentliche Rolle?” (**Do gravitational fields play an essential role in the structure of elementary particles?)**, Sitzungsberichte der Preussischen

Akademie der Wissenschaften, (Math. Phys.), 349-356 (1919) Berlin]. Time would slow when light is passing through denser matter if that density is due to greater concentration of gravitational waves (light's speed in vacuum is 3x10^8 metres/second, 2.26 x 10^8 m/s in water and 1.97x 10^8 m/s in glass). Maybe LIGO (the Laser Interferometry Gravitational-wave Observatory) should boost their technology by several decades and supplement detection of waves from colliding black holes with a search for the gravitational waves associated with subatomic particles.

NUCLEAR FORCES AND BLACK HOLES

Let's assume Einstein will once again be proven correct oneday and that gravitational fields really do play an essential role in the structure of elementary particles. If something "plays a role", the suggestion is that at least one more role-player is necessary to complete the formation of elementary particles. Could the other factor be the universal, long-range force of electromagnetism (gravitation and electromagnetism are the only long-range forces)? Einstein's paper seems to imply to modern science that the 2 nuclear forces are not fundamental but, like the matter they're associated with, are products of gravitational-electromagnetic interaction (which produces the mass of W and Z particles). This agrees with theories in which the role of the mass-bestowing 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). The above gravitational-electromagnetic union suggests the mass of black holes is also the result of gravitation plus electromagnetism. In a Black Hole, these energies reside together but temperature within a black hole is extraordinarily close to absolute zero. The extreme coldness prevents gravitons and photons interacting to produce matter in the form of clouds of dust and gas that can condense into stars.

The strong force is observable at two ranges: on a larger scale - 10^{-15} m: one million billionth of a metre or about 1 to 3 femtometers (fm) - it's called the residual strong force and binds nucleons (protons and neutrons) together to form the nucleus of an atom. On the smaller scale (less than about 0.8 fm, the radius of a nucleon), it's often known as the color force, is carried (transmitted) by particles called gluons, and the gluons "glue" quarks together to form hadrons (protons, neutrons and mesons). There's a similarity between black holes and gluons, in that gravitation plus electromagnetism reside together but don't interact. Since black holes are more massive than the Sun (sometimes billions of times more), their immense quantity of gravitational waves - involved in production of mass - makes them tremendously massive. The comparatively infinitesimal quantity of waves associated with gluons results in their mass, like the photon or graviton, being zero or practically zero. Particles of matter have a bit of mass.

Comparing black holes and gluons reminds me of the primordial black holes Stephen Hawking proposed about 1970. These were never discovered but would be subatomic in size. Do primordial black holes actually exist … in the form of gluons? Of course, this means our previous theories and calculations about black holes, and their primordial relatives, need revising. So would theories concerning gluons and other particles - "(Since individual quarks cannot be observed, it) is certainly possible that some alien beings with seventeen arms, infrared eyes and a habit of blowing clotted cream out their ears would make the same experimental observations that we do, but describe them without quarks." [Hawking S, Mlodinow L (2010) "The Grand Design" - Bantam Press, pp.49-50]. Could the supposedly partially outdated science of half a century ago be the key to this revision?

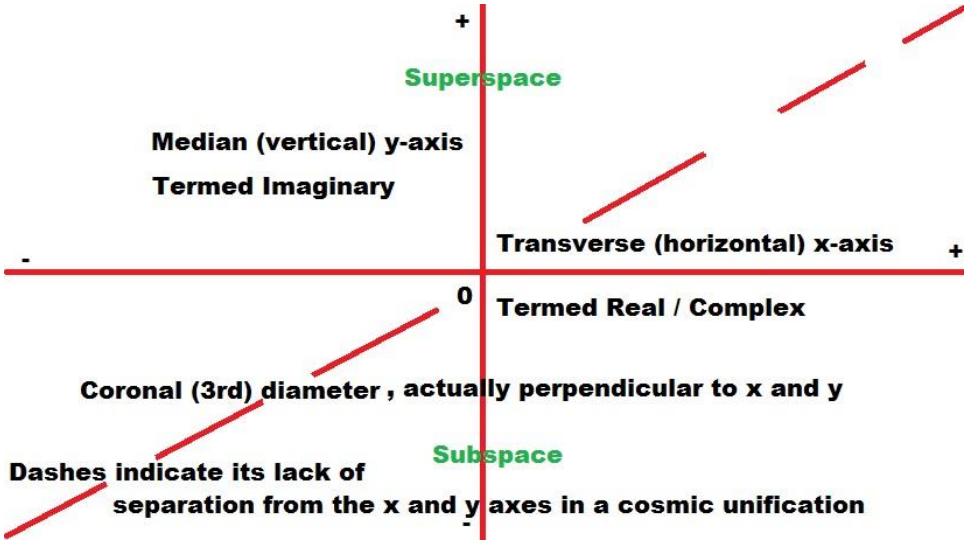
"(In 1970), there was no precise definition of which points in space-time lay inside a black hole and which lay outside." ("A Brief History of Time" by Stephen Hawking - Bantam Press, 1988, p.99)

Doesn't this leave open the possibility that a gluon in your finger just might be inside a black hole existing billions of years in the future, and that black holes provide constant access to all other regions of space-time? The binary states of on-off, or of increased energy-decreased energy, in pulsations of the virtual particles (gravitons) filling space-time can be represented by the electronic binary digits (bits) of 1 and 0. Just as "bit" is an abbreviation for "binary digit" in ordinary computers, "qubit" stands for "quantum bit" in quantum computers. Whereas the state of a bit is either 0 or 1, the state of a qubit can be a superposition (0 and 1 at the same time). The qubit is perpetually realized inside black holes because their gravitational and electromagnetic waves possess both forward and backward motion in time (see next section), cancelling to produce the zero time/zero distance called entanglement. 'Physicists now believe that entanglement between particles exists everywhere, all the time, and have recently found shocking evidence that it affects the wider, "macroscopic" world that we inhabit.' - "The Weirdest Link" (New Scientist, vol. 181, issue 2440 - 27 March 2004, page 32 - online at http://www.biophysica.com/QUANTUM.HTM). Caslav Brukner, working with Vlatko Vedral and two other Imperial College researchers, has uncovered a radical twist. They have shown that moments of time can become entangled too.(http://www.arxiv.org/abs/quant-ph/0402127). And, through entanglement with everything in space and time, black holes provide constant access to all other regions of space-time. (See the article "Soft Hair on Black Holes" by Stephen W. Hawking, Malcolm J. Perry, and Andrew Strominger (Phys. Rev. Lett. 116, 231301 – Published 6 June 2016) which speaks of black holes being portals to other universes.

COMPLEX NUMBER PLANE AND ANTIGRAVITON

Historically, mathematics often 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 over a century. So imaginary time and the Complex Number Plane might find applications undreamt of today.

^ **The ultraviolet catastrophe**, also called the **Rayleigh–Jeans catastrophe**, is a failure of classical physics to predict observed phenomena: it can be shown that a blackbody - a hypothetical perfect absorber and radiator of energy - would release an infinite amount of energy, contradicting the principles of conservation of energy and indicating that a new model for the behaviour of blackbodies was needed. At the start of the 20th century, physicist Max Planck derived the correct solution by making some strange (for the time) assumptions. In particular, Planck assumed that electromagnetic radiation can only be emitted or absorbed in discrete packets, called quanta. Albert Einstein postulated that Planck's quanta were real physical particles (what we now call photons), not just a mathematical fiction. From there, Einstein developed his photoelectric effect (when quanta or photons of light shine on certain metals, electrons are released and can form an electric current).



The Complex Number Plane has a leftward direction on the horizontal X axis which is called the "complex axis" and corresponds to backwards motion in time. The direction to the right on X is called the "real axis" and corresponds to forward motion in time, while the vertical Y axis intersecting the X axis represents the so-called Imaginary Time

derived from Special Relativity and quantum mechanics. There are 2 forms of spin - classical (e.g. a rotating top) and quantum. The latter can't be explained classically but may possibly be explained by particles and space mutually affecting each other. According to General Relativity, matter causes a gravity field by its mass creating depressions in space that can be pictured as a flexible rubber sheet. Space could affect particles through its curvature (gravity) infiltrating particles, thus giving them quantum spin. Curvature implies this quantum spin could be continuous. Since it's known this type of spin can only have discrete values, these values (and space's curves) must be determined by discrete pulses of energy that also transmit information (fluctuations / pulsing of virtual particles could produce the discrete values of binary digits' 1's and 0's). Space's curves influencing particles is consistent with Einstein's 1919 paper "Do gravitational fields play an essential role in the structure of elementary particles?"

"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 the gravitational fields carrying enough information about electromagnetism to allow Maxwell's equations to be restated in terms of these gravitational fields. Then the gravitational/electromagnetic waves composing matter would also have an "advanced" solution (and matter itself could journey back in time). Advanced gravitational waves are known as antigravity. Antigravity could be called dark energy and, if real gravity is involved in ordinary matter's mass-production, antigravity would conceivably be involved in the mass-production of other matter called "dark" (which would not be WIMPs, sterile neutrinos, axions or any particles that travel forwards in time). Dark matter belongs to a higher dimension where antigravity - gravitational waves going back in time - exists on the "complex axis" where complex time, following the principle that space and time unite as space-time, joins with complex space to form complex space-time. "Physics of the Impossible" states on pp. 277-278:

"These advanced waves were a mystery until they were studied by (20th-century American) physicist Richard Feynman, who revealed the true secret of antimatter: it's just ordinary matter going backward in time." If a positron or antielectron keeps journeying back from some point in our future (where different warps in its constituent

waves mean it was matter), it becomes what we call dark matter when it has gone beyond our present.

The "real" graviton (which possesses spin 2) interferes with the "complex" graviton because they both primarily travel along the Number Plane's X axis and are therefore in constant contact (in the zero time/zero distance - entangled - cosmic unification spoken of 5 paragraphs ago, they'd also branch out in all directions). Dr Feynman said antimatter results from reverse time travel so the antigraviton must be the same thing as the complex graviton (they'd both have spin of –2). Since the complex graviton shares an axis with the real graviton, it's acceptable to say (except for the quantum spin difference of –2 versus +2) that the antigraviton must be the same thing as the graviton - see "A Brief History of Time" by Stephen Hawking: Bantam Press, 1988, p.106 which states "the antiparticles of light and gravity are the same as the particles."

The +2 and –2 gravitons (a graviton in an angular-momentum eigenstate^ could have spin values of plus or minus two) can cancel and annihilate each other, producing photons of spin 1. Plainly, this is saying gravitation can produce electromagnetism – including the microwave photons alleged to be leftover from the Big Bang (if not produced directly, the'd be weakened by collisions with dust, gas and stars etc; and wavelengths would be redshifted by distance to microwave wavelength from a higher, possibly gamma-ray, wavelength). "Fermi (Space Telescope) detected the burst (the first detection of gravitational waves on September 14, 2015) just 0.4 seconds after LIGO detected gravitational waves, and from the same general area of the sky. However, the European INTEGRAL gamma-ray satellite did not confirm the signal. "Even if the Fermi detection is a false alarm, future LIGO (Laser Interferometry Gravitational-wave Observatory) events should be monitored for accompanying light irrespective of whether they originate from black hole mergers. Nature can always surprise us," says (astrophysicist Avi) Loeb." Dr. Loeb's quote is from "LIGO's Twin Black Holes Might Have Been Born Inside a Single Star" by Harvard-Smithsonian Center for Astrophysics: https://www.cfa.harvard.edu/news/201605

^ From German and Dutch, eigenstate applies to classical – not quantum - spin and is a characteristic state in which one of the variables describing it – in this case, angular momentum which is analogous to rotation – has a fixed value.

REINTERPRETING LARGE HADRON COLLIDER'S QUARK-GLUON PLASMA

The article "LHC creates liquid from Big Bang" by Eleanor Imster - September 15, 2015 - http://earthsky.org/human-world/lhc-creates-liquid-from-big-bang says,

"An international team at the Large Hadron Collider (LHC) have produced quark-gluon plasma — a state of matter thought to have existed right at the birth of the universe ... The results were published in the journal *APS Physics* on June 29, 2015." (note: the plasma behaves like a fluid)

"Viewpoint: The Littlest Liquid" by Jean-Yves Ollitrault, Institute of Theoretical Physics, University Paris-Saclay, France - June 29, 2015 - *Physics* 8, 61 (https://physics.aps.org/articles/v8/61) offers clues to possible reinterpretation of the proton-lead nucleus (*p*-Pb) collision which produced the quark-gluon plasma:

1) "Relativistic effects flatten the two projectiles" (the high-energy proton and the lead nucleus)

2) "The liquid that forms from the collision of two heavy nuclei is an “emergent” state, meaning it exhibits properties that cannot be simply extrapolated from the behavior of a few particles. Rather, the plasma’s behavior is quantitatively and qualitatively different than its individual components (quarks and gluons). This behavior results from the strong interactions between particles and is characterized by collective effects, in which each particle’s motion is correlated with that of the others. Such emergent phenomena are common in macroscopic systems, such as superconductivity in metals."

3) "Pairwise correlations between particles in the plasma produced by a collision between a proton and a lead nucleus. The correlations have a wavelike pattern …"

4) "… quantum fluctuations in the lead nucleus ... are imprinted on the resulting plasma as correlations between particles."

The viewpoint below focuses on three words from 1), 2), 3) & 4) - flatten, superconductivity & correlations.

The Cooper pair state is responsible for **superconductivity**, as described in the BCS theory developed by John Bardeen, Leon Cooper, and John Schrieffer for which they shared the 1972 Nobel Prize. A Cooper pair or BCS pair is a pair of electrons (or other fermions) bound together at low temperatures in a certain manner first described in 1956 by American physicist Leon Cooper. These have some bosonic properties – properties similar to photons, gravitons and the Higgs boson. Bosons, at sufficiently low temperature, can form a Bose–Einstein condensate which is an example of macroscopic quantum phenomena (quantum behavior at the macroscopic scale, rather than at the atomic scale where quantum effects are prevalent). The best-known examples of macroscopic quantum phenomena are superfluidity and **superconductivity**. The fact that bosons can form a Bose–Einstein condensate which

is related to **superconductivity** hints at **superconductivity** being a wave-function phenomenon. Also, the Complex Number Plane of mathematics in conjunction with the so-called Imaginary Time of physics suggests this wave-function might find practical application beyond abstract maths and could be multidimensional having "real", "imaginary" and "complex" types. The explanation of **superconductivity** by means of Cooper pairs confirms the validity of wave-particle duality.

Regarding zero electrical resistance: An electromagnetic wave can have its electrical part compressed, through eg introduction of copper-and-oxygen compounds called cuprates or use of hydrogen sulfide (speaking of molecules as well as waves refers to quantum mechanics' wave-particle duality). If compression is sufficient; the electric component no longer follows a long, curved path in Euclidean geometry. Its path is now linear (or "**flatten**ed") and follows the shortest distance between two points. In other words, a superconductor that operates at room temperature and normal atmospheric pressure has been manufactured. Any resistance would, like a rock in a stream causing water to flow around it, lengthen the distance and mean the compound is not a perfect superconductor.

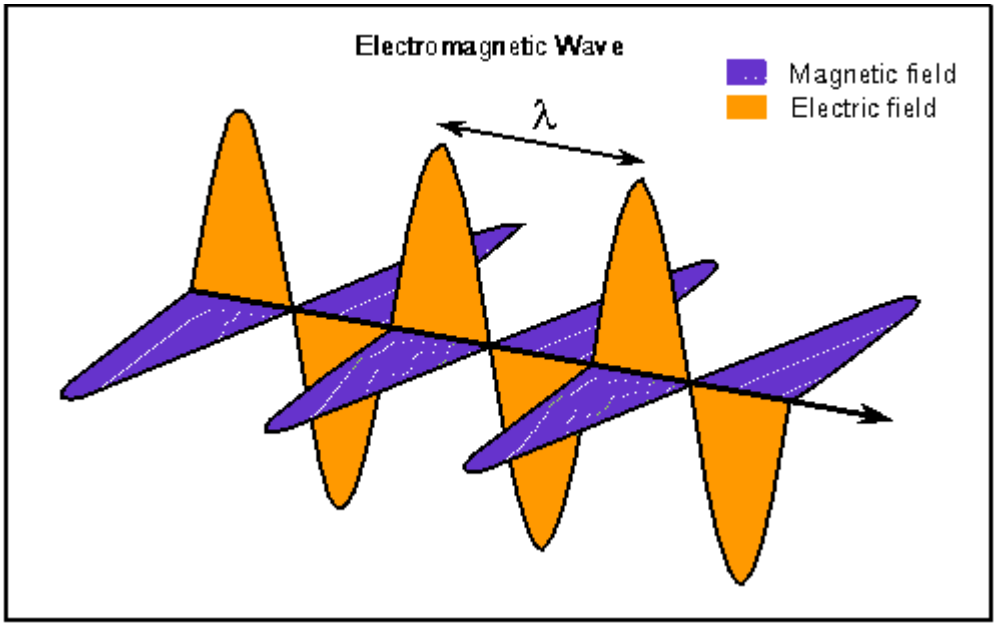


figure number 2 - an electromagnetic wave showing electric and magnetic fields, and the wavelength (λ) which is the distance between crests of a wave. Courtesy of nrao.edu

The mention above of "flattened" electric waves, and of superconductivity possessing qualities such as wave-function and wave-particle duality, is consistent with the statement in "The Littlest Liquid" that "The correlations have a wavelike pattern …"

That article's line "… quantum fluctuations in the lead nucleus ... are imprinted on the resulting plasma as correlations between particles" may adopt "a wavelike pattern". The line could then be expressed as: electromagnetic and the ubiquitous gravitational waves of Einstein's 1919 paper "Do gravitational fields play an essential role in the structure of elementary particles?" are imprinted on the resulting plasma as correlations between particles. The gravitation-electromagnetism might produce proton and neutron particles in the lead nucleus (possibly including the particles of its associated two nuclear forces). But how could the interaction of those waves produce correlations? The answer is: through the Maxwell-Einstein equations for retarded and advanced waves. The former travel forwards in time, the latter go backwards - and the combination can cancel to produce zero and correlated, entangled particles.

According to this article's 3rd paragraph, not only lead nuclei but all matter can be formed from the properties of gravitational and electromagnetic waves. Could the discovery of all particles be reinterpreted as the discovery that every particle – not just quarks and gluons – is part of a continuum of waves? Particles throughout the Cosmos and every period of the Universe's existence would be points where that continuum's waves concentrate and interact to intensely warp space-time, just as islands are concentrations of atoms within the atoms making up oceans. All spaces and all times would be part of a Cosmic Unification ie space-time, complex space-time and imaginary space-time influence one another. This enables real space to be combined with imaginary time so travel to any other galaxy can be done instantly because absolutely no time elapses in familiar real time.

This article could be summed up by paraphrasing a line commonly attributed to Dr. Leonard (Bones) McCoy – played by DeForest Kelley - from the original "Star Trek" (it actually originated with the 1987 song *Star Trekkin'* by The Firm, which was making fun of Star Trek). The song's 3 writers had Bones say, while speaking to the starship Enterprise's Captain James T. Kirk - "It's life, Jim, but not as we know it." Rewording that quote, we can now say – It's a QGP*, Jim, but not as we know it.

SHAPE OF SPACE

* In this case, QGP is Quark/Gluon/Particle, not the scientific world's Quark-Gluon Plasma. When people hear "antigravity" or "quark-gluon plasma"; many tend to think of

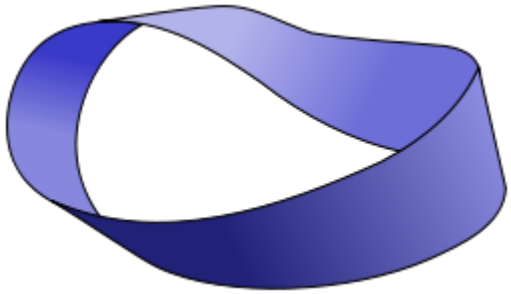
the Big Bang, expanding universe, and cosmic inflation. It's possible that the universe is not physically expanding at all - but is undergoing the closely related, yet definitely not identical, process of mathematical extension. Mathematics' Poincare conjecture has implications for the universe's shape and says you cannot transform a doughnut shape into a sphere without ripping it. This can be viewed as the universe being made up of Figure-8 Klein Bottles. Described informally rather than in the strict conformity of mathematical formalism, these are similar in shape to doughnuts: joining a pair of two-dimensional programs called Mobius strips* forms a four-dimensional Klein bottle (http://plus.maths.org/content/os/issue26/features/mathart/index). Bottles affect every sense and scientific probe because the pulses forming them also form the complete properties of the Gravitational-ElectroMagnetic Field. The cosmos gains rips called wormholes when extended into a spherical spacetime that goes on forever, forming one infinite universe. Regarding spherical spacetime - "The Shape of the Universe" by Stacy Hoehn, formerly of Vanderbilt University's Mathematics Department (https://my.vanderbilt.edu/stacyfonstad/files/2011/10/ShapeOfSpaceVandy.pdf - October 13, 2009) says,

"No matter where we have been in the universe so far, if we choose a spot and travel out from it a short distance in all directions, we enclose a space that resembles a solid 3-dimensional ball. Thus, the universe appears to be some 3-manifold."

(My comment: Before it becomes infinite in size with corresponding flat curvature, the universe's shape is dictated by the shape of the figure-8 Klein bottles composing it ie both bottle and cosmos are roughly spherical and possess closed, positive curvature on small scales. The Mobius strips and figure-8 Klein bottles account for General Relativity's positive and negative curvature of space-time: see the diagram below of a figure-8 Klein bottle which embodies both spherical and hyperboloid or saddle-shaped space).

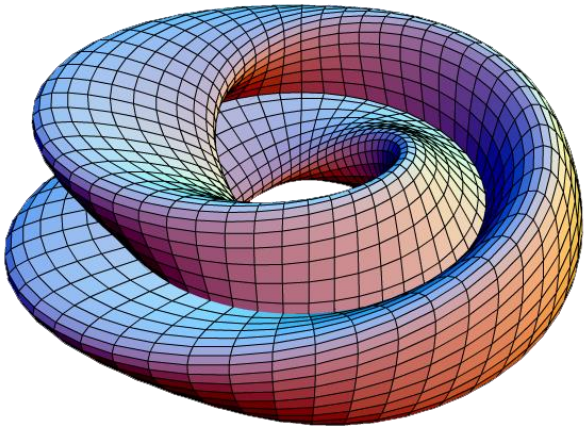
* These strips are written or encoded with binary digits produced by the on-off pulsations of the Virtual Particles filling space (the "particles" are really fluctuations in the universal gravitational-electromagnetic field and therefore equivalent to energy pulses). Motion of virtual particles is regarded as random. However, Chaos theory which, after Relativity and quantum mechanics, has been called the 3rd most important theory of the 20th century puts hidden order into apparent disorder. Binary digits could therefore be the Hidden Variables – an interpretation of quantum mechanics which believes the theory is incomplete, and that hidden variables could give exact predictions about the quantum world.

Mobius Loop (source: http://www.polyvore.com/mobius_strip_public_domain_clip/thing? id=72360021)



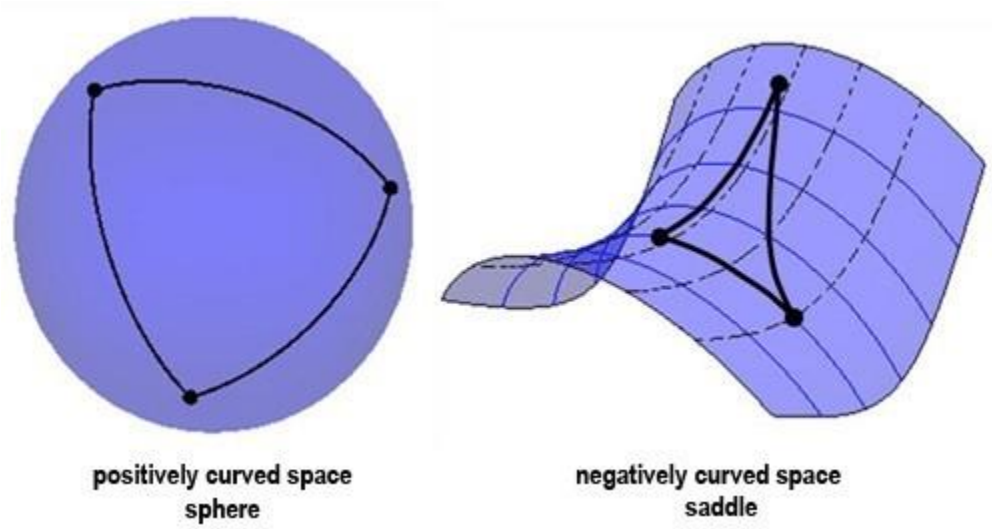
Joining two Mobius strips (or Mobius bands) forms a four-dimensional Klein bottle [Polthier K, "Imaging maths - Inside the Klein bottle" http://plus.maths.org/content/os/issue26/features/mathart/index]

Figure-8 Klein Bottle (source: http://commons.wikimedia.org/wiki/File:KleinBottle-Figure8-01.png). Note that the reddish positive curvature fits together with the bluish negative curvature to produce the flat curvature of space-time's infinity/eternity.



Regarding infinite universe - "Infinite Universe" by Bob Berman ("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 largescale structure, and the flat topology of space – all point the same way."

This can be explained by positive, spherical curvature fitting together with negative, saddle-shaped or hyperboloid curvature to cancel on the largest scales and produce the flatness of space-time's infinity/eternity.



Thanks to https://www.quora.com/What-does-the-universe-is-flat-mean