Evaluation of Mach's Principle in a Universe with four spatial dimensions

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Abstract

Recent cosmological data shows the Milky Way galaxy being pushed ahead of a void. Independently, laboratory research has created matter with negative mass. A possible relationship between these seemingly unrelated results indicates the need to reexamine our understanding of gravity. According to the Page and Wootter mechanism, time is static globally, but emergent for 'internal' observers. That is, interaction increases the energy-information differences among the constituents of the cosmos. Such temporal evolution engenders polar singularities, known as black and white holes, in accordance with general relativity. The second law of thermodynamics leads to Landauer's principle, which shows that the emitted heat is proportional to the erased information of the system. Thus, information accumulates heat in black hole horizons, which have been found to be two dimensional; whereas information-free areas are energy rich and cold. The principle of static time dictates information and dimensional complementarity between antipodal areas of the universe. Two dimensional, positive curvature black holes must be balanced by negative curvature, four dimensional white holes, which expand space and lead to the experience of 'dark energy.' Positive curvature forms great field strength, which stabilizes the universe with a pressure experienced as excess gravity, called dark matter. Enhanced field strength leads to clumping, forming planets, stars, galaxies and galaxy clusters, which slows expansion. The dimensional anisotropy (two in the black holes and four in the white holes) straddle unstable, three-dimensional galactic environments between them. An object's position in space corresponds to a freely hanging plumb. Deviations in angle of that plumb (position of the object) – thereby changes the equilibrium of the whole universe and leads to inertia, a force that is proportional to both the mass of the object and the field strength (i.e. radial topological distance from the center). Therefore inertia is greatest in the vicinity of the black holes. On the positively curved polar surfaces of space (such as a planet) a path that curves toward the pole forms the shortest distance. On positive curving temporal surfaces the shortest time is acceleration, which leads to the twin paradox. The hypothesis is congruent with the latest CMB data, satisfies Mach's principle as well as Occam's razor by uncovering a surprisingly simple, stable and unified alignment of the universe. This new physical world view is presented with visual illustrations.

Key words: Mach's Principle, Static time, Landauer's principle, AdS/CFT correspondence, holographic principle

Introduction

Current scientific knowledge has supplied us with a detailed understanding of the material world and cosmic phenomena. However, the overall topology and deep structure of the universe is still an unsettled question in astronomy and cosmology. Discrepancies in the universe large scale structure made it necessary to introduce two new forces, dark energy and dark matter. Dark energy is meant to explain the experienced expansion, which strangely correlates with excess gravity near gravitational regions. Newton's gravity is the famous inverse square law. However, over large distances (the value, 0.00000000012 m/s/s is considered a new constant of nature), gravity reduces linearly with distance. The introduction of Modified Newtonian Dynamics (MOND) is expected to recognize and remedy this change. The rotation speed of visible matter at any given distance from the galaxy's center is tightly linked with the amount of visible matter contained within that galactic radius, dubbed the "radial acceleration relation." Dark matter contribution is also fully correlated to the baryon distribution (McGaugh et al., 2016).

Newton relied on a series of unrecognizable absolute fixed points that served as a reference for the real locations and motions of the physical bodies. Einstein's general relativity also fails to follow Mach's principle, because spacetime should lose its metric properties in a space devoid mass and energy. In general relativity, components of the metric tensor reduce only to their Minkowskian values in empty space. Moreover, the validity of both Newtonian gravity and GR are limited to the scale of the solar system, but fail at the galactic and cosmic scales. GR is also incompatible with quantum mechanics and cannot explain the arrow of time. Quantum theories are extremely successful, but their fundamental understanding is problematic. The goal of finding the fundamental natural constants remains unrealized, as are generally valid equations of motion. Energy conservation is not a well-founded idea, the nature of time is a mystery and its direction is not understood. We do not know what matter actually is. Sometimes a conceptual jump is necessary in scientific understanding. Below I describe a new physical world view, which can unify quantum mechanics and general relativity, satisfy Mach's principle and solve a number of unexplained mysteries of physics. In order to develop a coherent physical world view, we must examine the foundation of the cosmos.

The cosmological principle, which is based on our experience of a fairly homogenous distribution of galaxies and other objects, states that on the largest scale the universe is both homogenous and isotropic. The astonishingly even temperature of the CMB shows the universe at the point of its formation spatially flat, with nearly scale-free, Gaussian fluctuations, and isotropic in all directions. However, over time, the large scale topological shape of space might have changed dramatically. In our everyday experience, time seems to mark change in the universe, but the Wheeler-De Witt equation, formulated as principle of static time, predicts a static cosmos (Page and Wootters, 1983). Thus, evolution is only experienced by internal observers. Quantum entanglement permits a time evolution of a "clock" system against the rest of the universe, whereas yielding a stationary state for an (hypothetical) external observer. This opens the possibility for the anisotropic structure of space, which might to follow Mach's principle, a necessary and inevitable dream of physics. Mach's principle has been well summarized by TelKamp (2012): 1. The inertia of a body depends more on masses in its neighborhood, than over larger distances in the universe. 2. A body must experience an accelerating force in the direction accelerating neighboring masses. 3. A rotating hollow body must generate inside of itself a "Coriolis field." 4. True vacuum does not exist. In relativistic theory the separation of time and space leads to the curvature of the field.

In the following a new model of space is proposed that fully satisfies the above requirements.

Discussion

Foundation of the hypothesis

In string theory, particles are separated by an information-blocking horizon into microdimensional energy vibrations (Veneziano, 1968). This way, interaction becomes a volume shift between micro and macrodimensional space, i.e., particle and field. The Lorentz transformation expresses their orthogonal, interdependent, and complementary relationship. The mechanism of "static" time (Page and Wootters, 1983), predicts an unchanging universe, in which participants evolve via entanglement (Moreva et al., 2013) that entails complementary transformations over great distances and results in energy conserving zero sums. Because spatial contraction leads to positive curvature, vacuum is prohibited. Instead, entanglement evolves spatial curvature and forms the topology of cosmos. The edges the field might degenerate into poles: information-saturated black holes and information-free white holes, which expands space. Between the poles, the greatest complexity is formed along Euclidean spatial field, corresponding to over ten billion years old matter. As time grows into infinity due to the information accumulation of the microdimensions, space collapses into two-dimensional black hole horizon (Susskind, 1994). Additional material to help visualizing main concepts of the hypothesis is available at the end of the manuscript.

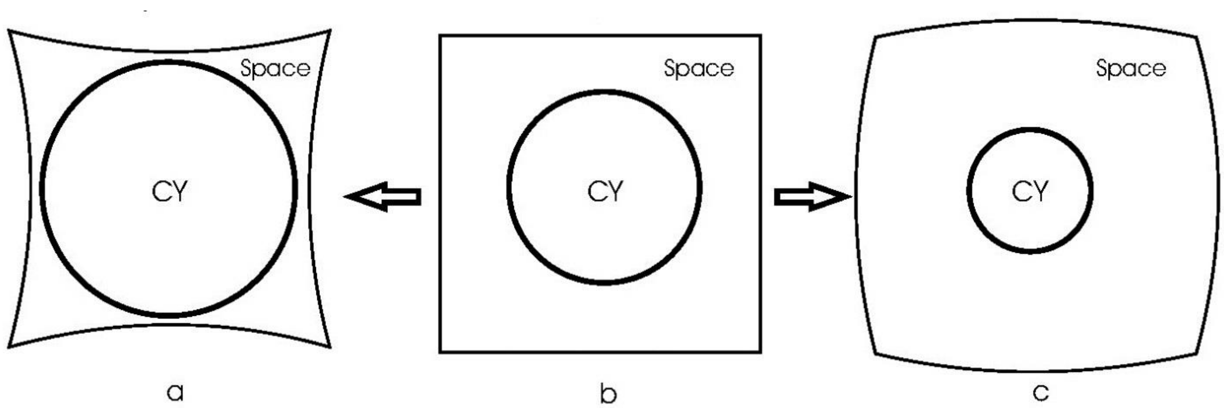

Figure 1. The possible outcomes of interaction. CY indicates the microdimensions and Space indicates macrodimensional space (b) The central image represents the microdimensions and the field before entanglement. (a) During downspin the microdimensions expand and macrodimensions contract and engender positive spatial curvature. (c) In the up spin state the microdimensions contract, whereas macrodimensions expand, initiating negative curvature. The actual volume changes are exaggerated for illustration.

Interpretation of the wave function:

In the Bohmian view of quantum mechanics (often called the de Broglie–Bohm theory) the trajectory of any one particle depends on what all the other particles described by the same wave function are doing. The wave-function is insulated from space, gravity and time, therefore, the wave function has no geographic limits; it might, in principle, span the entire universe. This means that the universe is weirdly interdependent, even across vast stretches of space. Nevertheless between the poles, nearly infinite energy configurations of the particle's discrete energy level can formulate via entanglement or during the double-spit experiments. However, the particle energy changes in every interaction; interaction is a switch between the discrete particle energy levels, which forms a stepwise progression between the poles of the cosmos. The discrete energy vibrations correspond to the 'age' of particle, a stepwise progression of frequencies between the poles (Figure 2). Interaction in double slit experiments occurs on the screen. However, interaction can occur in a detector behind one of the slits, which switches the energy-level (frequency) of the wave-function for the whole particle, leads to nonlocality and the illusion of time travel. This intuitive solution, which has eluded science for the past one hundred years, indicates that this new vision on the foundation of the cosmos must be the correct description of reality. The particles' discrete character in quantum mechanics is in stark contrast to general relativity, where the field changes smoothly between points (Figure 2, Macrodimensions). The discrepancy (that particle energies form a discrete series, whereas gravity forms a smooth field) is at the heart of the conflict between the two fields of physics. However, particle waves connect with the field only during decoherence, i.e., during the collapse of the wave function and the two formulate a congruent evolution. The wave function combines — or binds —entangled particles into a single irreducible reality over great distances.

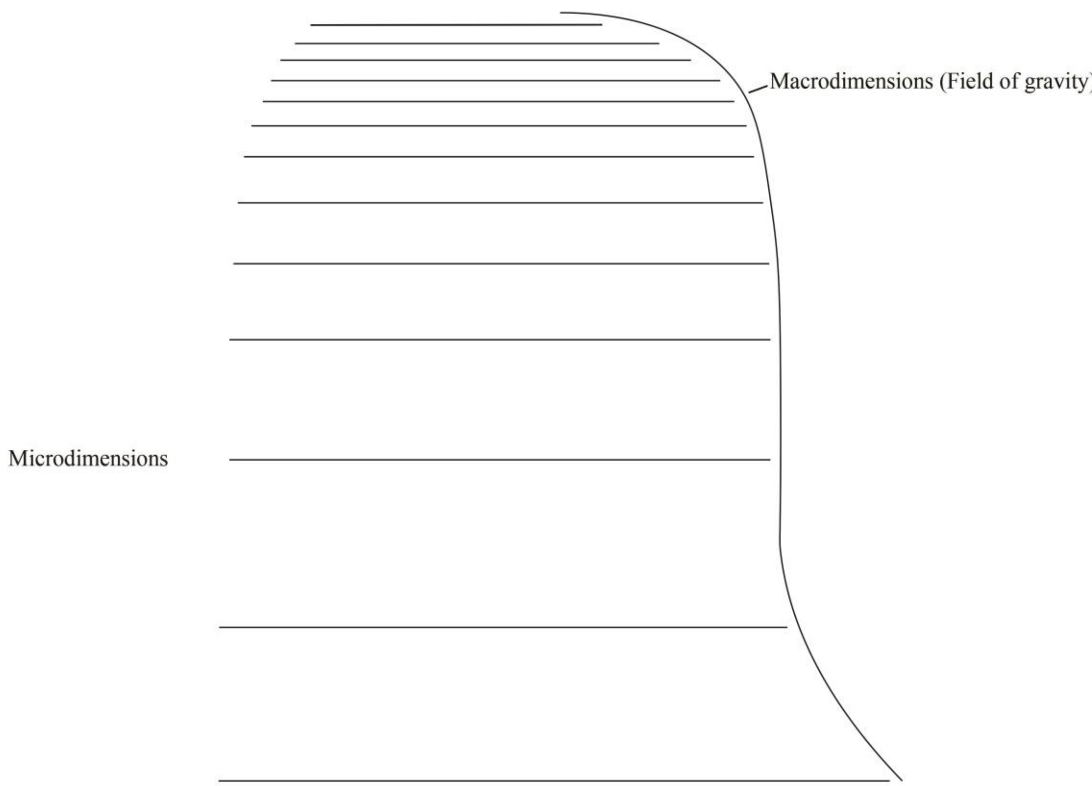

Figure 2. The structure of the universe. Microdimensions form discrete energy levels. Entanglement leads to a parallel evolution of the micro and macrodimensions. Over larger scales, the volume changes lead to either contraction (i. e., positive curvature) or expansion (negative curvature) of space.

Gravity

In general relativity space is represented as a trampoline net, where large objects curve spacetime, but leave empty space flat. However, this picture might be arbitrarily simplistic. So far we have seen that the particle connects to the field that is congruent with its spatial geometry, spin and energy level. Intuitively, this occurs, because the particle shapes the spatial geometry depending on its wave function and spin, excluding the possibility of vacuum. Therefore, neighboring particles with identical spin form energy maxima (Figure 3). Only opposite spin neighboring particles maintain the Euclidean field curvature, satisfy the principle of least action, and the principle of static time. This energy conservation requirement is expressed in the Pauli exclusion principle. Although the principle involves the smallest energies (i.e., the elementary particles), nevertheless, it produces gravity via the immense energy differences and structural complexity of the universe. Gravity is the weakest of the four elementary forces, but it accumulates over the largest scales of space, because it crosses any shield and affects all particles. These qualities give gravity a ubiquitous and powerful presence in the universe. However, the information-blocking horizon of the microdimensions insulates from gravity, permits the wave function's instant presence, such as entanglement, throughout identical field curvature space. However as shown earlier, interaction shapes space by *redistributing* volume between the micro and macrodimensions (Figure 1). Space expands when volume moves to macrodimensions, whereas space contracts when volume moves into microdimensions (Figure 1.a,c). These contrasting volume changes lead to the inverse square relationship of Newton's formula. Thus, interaction curves space (Déli, 2015). However, the inverse sine function is a non-linear relationship, which necessitated the introduction of MOND. The derivative of the inverse sine function expresses the immense topological spread of Euclidean field in the universe (Figure 3), which permits the use of the linear light cone in the description of the light. The curve also shows that by aligning toward increasing spatial curvature, older matter traps more light. The non-linearly changing topology of space that culminates in the black holes might lend the experience of dark matter.

Regions with the greatest frequency of interaction form positive curvature and contract space by moving extra volume toward the periphery, decreasing field strength there. Because vacuum is prohibited, curvature changes modify the dimensionality of space. When curvature takes negative values, space expands into the fourth dimension forming antigravity within cosmic voids. Positive spatial curvature forms pressure, experienced as gravity, and reaching its extreme at the dimensionality loss of black holes. Hence, black hole horizons form impenetrable and two-dimensional outer-boundary of the cosmos (Almheiri et al., 2013), which slows expansion due to their great field strength. The resistance of Euclidean field to dimensionality changes causes the unexpected formation of particles, dubbed as 'vacuum energy.' The expansionary potential of cosmic voids gives rise to dark energy. The dimensional anisotropy of space satisfies the principle of static time. Since material interaction is isotropic (there is no preferred direction, or directional differences in reaction speed), dimensional anisotropy cannot be measured by the Hughes-Drever type experiments. However, dimensional anisotropy causes the gravitational deviation of the speed of the clocks and it causes fractal fragmentation resulting from collisions, the formation of greater mass particles in accelerators and the antigravity effects of vacuum (i.e., the special expansion). In conclusion, the microdimensional field is isotropic and forms uniform matter distribution in all spatial directions. Therefore, the above arguments suggest that the large scale picture of space provided by general relativity, specifically imagined as a trampoline net, is false. Instead, large object contract space, causing pressure and dimensionality reduction, whereas empty space expands and develops negative spatial curvature. This simple picture satisfies physical laws and Mach's principle. The contrasting dynamics of the poles satisfy the Heisenberg uncertainty principle in the following way. White holes form precise time (time zero), but uncertainty of position (space is infinite there), whereas black holes form precise position (point-like), but an uncertainty of time (time is infinite). This cosmic uncertainty is preserved in individual interaction.

The basic premise of twentieth century physics has been the Cosmological Principle, that on its largest cosmic scales the universe is both homogenous and isotropic. However, the existence of the poles strongly contradicts this premise. Dimensional anisotropy is formed because space is compacted into two dimensions in black holes, whereas in cosmic voids space extends into the fourth dimension, which leads to expansion and the cosmologic red shift.

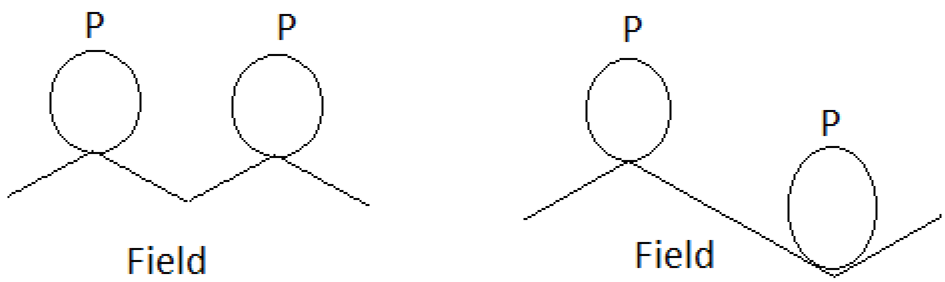

Figure 3. Geometric basis of the Pauli exclusion principle „P” indicates a particle (fermion), „Field” indicates the spatial field curvature. (a) Two neighboring particles, both with down spin, form identical spatial curvatures, their connection form a local energy-maxima configuration. The same is true for neighboring up spin particles. (b) Two neighboring particles with opposite spins. Between them the spatial field forms minimal-energy configuration, as indicated by a straight line.

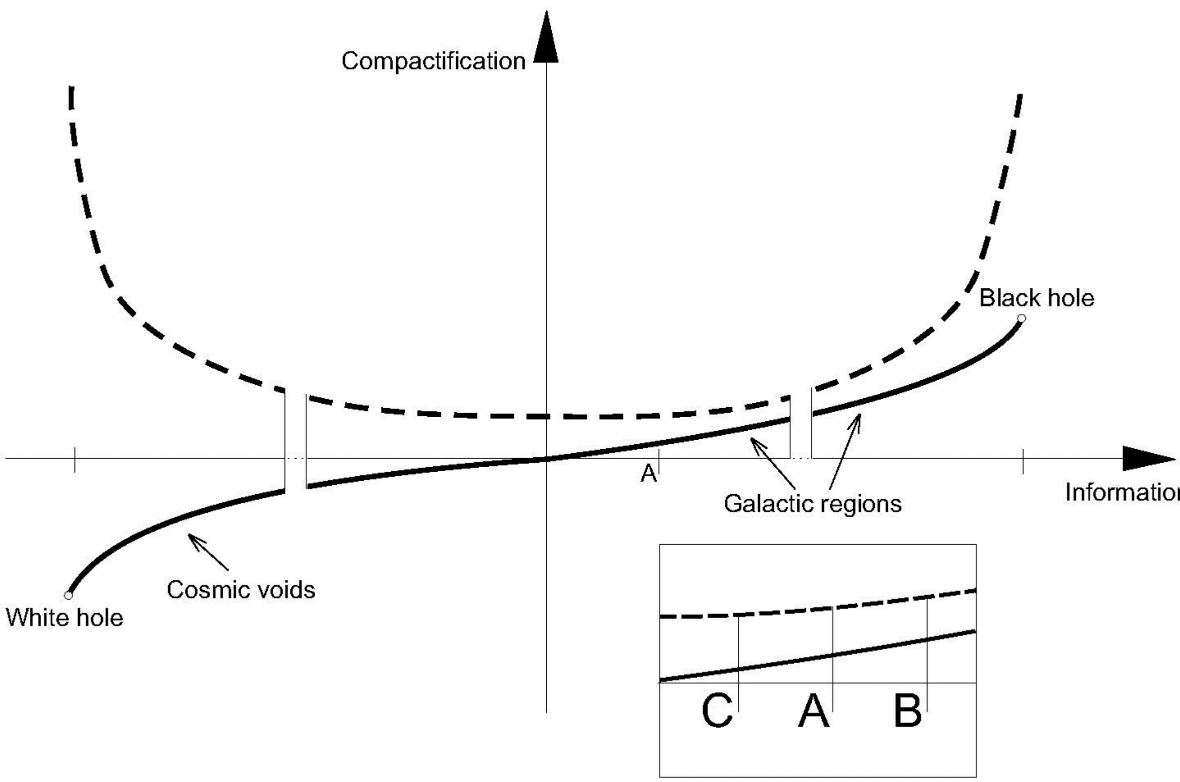

Figure 4. The four-dimensional universe The x axis is the information-energy ratio that can be thought of as the age of the coordinate. The y axis represents the spatial curvature via compactification of space into the microdimensions, thus it can only be traversed by acceleration. In the following convention, microdimensions are designated as positive space. Therefore, white holes form at negative time and negative space (macrodimensions), whereas black holes form at positive time and positive space (microdimensions). Compactification changes the geometry of the horizon (the gravity-field curvature) according to the inverse sine function, as shown by the solid line. It is the limit of information transfer in the universe: the speed of light. The curve replaces the ‘light cone.’ Positive field curvature formulates the galactic regions, and negative field curvature is typical of cosmic voids. The

curve’s derivative (the Lorentz contraction equation) is the speed of field curvature change, represented by the dotted line. The dot (A) designates the totality of possible experiences of biological systems inhabiting the surface of a planet. The inset shows the total range of possible field curvature and temporal changes encountered due to minor changes of gravity. The dot (B) shows the effect of enhanced gravity. The compactification speeds up and slows the inner clock of material systems. Within smaller field strength, the speed of compactification is smaller, allowing clocks to run faster (C).

Solid line: The inverse sine function shows the spatial volume change as a function of information accumulation (age), the source of Landauer’s principle and gravity.

Dotted line: Lorentz transformation indicates the immense energy need of acceleration.

Landauer's principle, which states that a minimum amount of energy has to be dissipated when erasing a bit of information (Landauer, 1961), was recently confirmed by Bérut and colleagues (2012) and others, in a series of increasingly sophisticated experiments (Koski et al., 2014, and others). The thermodynamic connection of energy and information means that information saturated areas heat up, whereas energy rich regions lose temperature. Our understanding of the black holes supports this notion: their information saturated horizon has high entropy and their immediate environment displays the highest activity and temperature. Furthermore, general relativity predicts that the infinite field curvature of black holes is a point-like singularity (devoid of space) that thus can be considered the polar boundary of the universe. Amheiri and colleagues (2013) have confirmed that black hole horizons cannot be approached and thus, they are the edges of space.

The principle of static time dictates that dimensionality loss of black holes must be counterbalanced by expansion and the formation of a four dimensional, energy enriched pole (Altshuler, 2012). The emerging negative spatial curvature loses information content and accumulates energy. Based on Landauer’s principle we can predict that energy rich singularities must be cold and non-interacting spaces. Looking at the universe, the cosmic voids satisfy the above requirements. Solution to Einstein's field equations, known as the maximally extended version of the Schwarzschild metric, includes white holes. Their description fits expanding cosmic voids. This idea gained new support by Braun and colleagues, who found that producing negative absolute temperature in the laboratory led to negative pressures with gravity defying particle behavior (Braun et al., 2013), akin to dark energy. For example, antimatter effects have been noted (Khamehchi et al., 2017) and the Milky Way is being pushed out by a void, called the Dipole Repeller (Hoffman et al., 2017). In addition, space shows a cellular structure, with cold empty voids (about 70 μK lower than the average cosmic temperature) being separated by attracting gravitational regions and the seeds of these cosmic voids were observed in the Cosmic Microwave Background Radiation (CMB) (Cai et al., 2016). Furthermore, cosmic voids show negative gravitational lensing signal (Melchior et al., 2014). The above the data is difficult to interpret without considering the dimensional anisotropy of space, in which cosmic voids act as opposing Polar Regions of black holes.

The holographic principle dictates that description of a volume of space is encoded on its boundary (Susskind, 1994). The AdS/CFT correspondence (Juan Martin Maldacena, 1998) recognizes that compactification of an anti-de Sitter universe would degenerate into a lesser dimensional boundary. Thus, Black holes can be considered the boundary of the anti-DE Sitter space (white holes). The work of Almheiri and colleagues, who determined that black hole horizons are impenetrable fire walls, strongly supports this notion (2013). The symmetry requirement of static time predicts that black holes must co-occur with a four dimensional expansionary potential of the white holes (Figure 4, 5). The spatial topology of the cosmos can be modelled as a Breton hat with the black holes occupying the positive curvature top, whereas the negatively curving brim represents the white holes. The four dimensionality of space satisfies the requirement of the Lorentz group and suggests the instability of three dimensional space. It is accepted that information saturated black holes form high entropy, but surprisingly, recent work on self-ordering of convex shapes shows that entropy can also increase order (Haji-Akbari et al., 2009). Therefore, white holes might form high entropy due to lack of information! Euclidean regions with their equal amount of information and energy content have low entropy and form highly unstable, dynamic galactic zones with constant interaction due to the twisting by the poles. This idea shows that the universe Polar Regions, due to their opposing dynamics, force constant interaction and low entropy on the Galactic Regions. This so called, ‘low entropy principle’ ensures the universe’s long term evolutionary potential.

Within gravitational regions time is largely one directional, and points toward the black holes. In black holes time grows to infinity, whereas it is point-like in the white holes. This way time stretches between the poles and forms the basis of a cosmic symmetry. White holes expand space, so nothing, not even light can approach them, making their experimental study an intractable problem in cosmology. White holes’ negative curvature acts as negative gravity (antigravity), whereas the great field strength of positive curvature stabilizes the universe by countering expansion (Figure 5). The existence of two Polar Regions is required for the global static state. Moving toward the black holes would destroy life and eventually material structure as well. Moving closer to the expanding white holes reverses the direction of time, but this means a lack of interaction; an end to biological systems and even matter. Thus life is exclusive property of mild gravity regions. Thus, time and space form the basis of a cosmic symmetry in the universe. Therefore, the hat in Figure 5 could also represent the temporal field, which formulates negative curvature in the black holes (forming the brim), whereas at the top of the hat white holes would form positive temporal curvature, time zero. Changes in temporal curvature lead to the twin paradox.

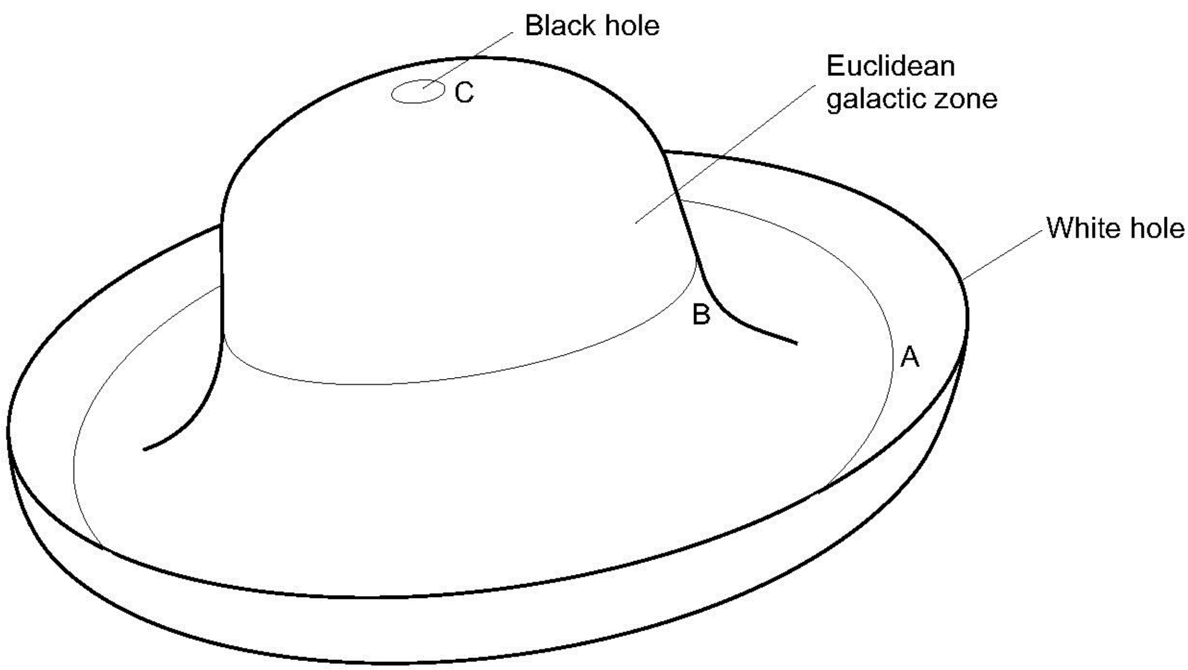

Figure 5. The topology of the universe. The positive field curvature loses dimensionality by compactification, which culminates in the two dimensional black holes, as time expands to infinity. Euclidean field is three dimensional, therefore unstable, forming constant interactions. The white holes form zero time and no interaction. In white holes hyperbolic geometry expands space into the fourth dimension.

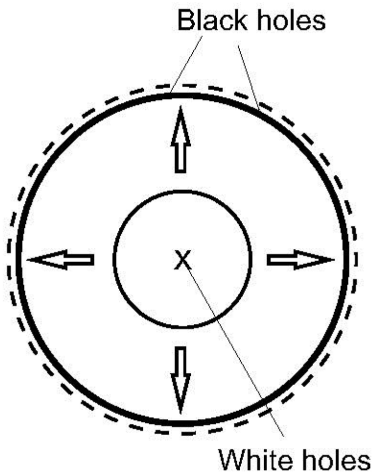

Figure 6. The topological structure of the universe. The information saturated horizon of the black holes forms an unapproachable, two dimensional fire wall. In the center marked by x, the four dimensional vacuum of the white holes expand space. The opposing dynamics of the poles force constant interaction within Euclidean regions and galactic areas. We are beneficiaries if this instability, which leads to incessant activity and constant change, ultimately engendering evolution. Inertia, which appears to be instantaneous, is proportional to field strength. Hence, inertia is small in the center (white holes), whereas at the edge of space (near the black holes) inertia approaches infinity. Objects moving with constant speed move on along the constant temporal latitude of the universe (along concentric circles).

Twin paradox

The speed of information transmission (the speed of light) engenders differences in gravity i. e., age, which imposes cosmic boundaries. The physical effects of inertial forces in accelerated reference frames are equivalent to the effect of the gravitational force in a frame at rest on the surface of a massive body, leading to the equivalence principle. Nevertheless, the principle of static time can distinguish between the two situations, based on the direction of information transfer (i. e., the direction of time). In general relativity simultaneity is measured by sending light to two clocks from a point halfway between their positions. In negative curvature space the light must travel greater distance, whereas it transverses smaller distance within positive curving space. Since light speed is the information transmission ability of space, the relative velocity difference represents a physical mechanism responsible for the different reading of the clocks. Temporal topology forms the world line. Therefore the age of a coordinate (cosmic clock) is congruent with topology and in line with Machian principles (Figure 5,6).

The two poles keep the universe in constant, stable and unified alignment that satisfies Mach's principle in the following way. Object position corresponds to a freely hanging plumb. Deviation in angle of the freely hanging plumb – thereby changes the equilibrium of the whole universe and also leads to inertia. Plumb lines are intersecting perpendicularly the surfaces of equal potential; that is at every point the inertial vector is perpendicular to the plumb line at that point. Inertia acts against change of position; the force being proportional of the mass of the object and the field strength (i.e. radial topological distance from the center). Therefore inertia (and age) is greatest in the vicinity of the black holes and vanishes within cosmic voids. In contrast, distance vanishes near black holes and expands, due to negative spatial curvature, in cosmic voids. Hence, the universe is infinitely resistant to rotation or tilting. This is a cosmic fermionic quality ─ and the *extension* of static time ─ that ensures that only whole spin can be measured. Correspondingly, observations of the cosmic microwave background radiation have put an extremely small upper limit on the frequency of rotation of the universe (Annila, 2016). Rotation of the local inertial frame with respect to the frame of the distant matter has not been detected, supporting Mach's principle. In contrast to GR, where vacuum spacetime is flat, vacuum is enhances the dimensionality of space, leading to expansion. The universe structural unity also leads to a gyroscopic effect, which is a force that is proportional to the local spatial curvature, such as the perihelion of planets and stars.

The dimensionality differences of the poles form the topological surface of the universe as follows. The dimensionality increase of negative curvature regions form expanding energy hills (i.e., cosmic voids), which repel matter. At the same time, lesser dimensional, positive spatial curvature regions correspond to energy valleys (e.g., large objects), which contract and therefore accumulate matter. This has been spectacularly corroborated by recent spectroscopic surveys based on the SLOAN Digital Sky Survey (Tully et al., 2014). Voids repel galaxies (pushing the Milky Way also) by acting as antigravity, whereas positive curvature regions attract and gather galaxy flow (Einasto et al., 2012). Galaxies increase local field strength via material interaction, which in turn increases gravitational pull on the movement of subsequent galaxies. The superclusters enclose a 3D region that channels galaxy movement outward funnel-like, arranging galaxy flow into filaments, similar to converging rivers and watershed. By making curvature differences apparent, these large scale dynamics delineate the topology of the universe: the black holes losing dimensionality cause the formation of flat structures, discs, and walls, whereas the increasing dimensionality of white holes (voids) forms bubbles. Voids, such as the Great attractor and super void, therefore form demarcation between attractor basins. The cosmic topology is clearly shows the anisotropic structure of space. These large scale dynamics might be behind currently unexplained motion of some galactic clusters. Massive cosmic flows indicate a vastly greater universe than predicted by observations. The expansionary potential of the voids and the contraction within gravity bound regions form the opposing dynamics of space. This large scale topology can be viewed as a harmonic motion. The frequency of harmonic motion corresponds to the event frequency in gravitational relationships, and the field curvature is analogous to the tension of the spring. Harmonic motion results from the tension between positive and negative spatial curvature. This way, the topological differences within the universe on its largest scales are enhanced by the simple Hooke's law. The principle of static time dictates that the spatial curvature differences increase over time and over space, while the overall energy neutrality of cosmos is conserved. This has immense ramification for our view of the cosmological constant. In an accelerating universe the cosmological constant is negative; the field strength of the black holes cannot keep up with the expansionary energy of white holes. However, white holes give rise to space with zero information. Their expansionary energy spurs interaction all over space, giving rise to matter and cosmologic evolution, with a potential for biologic evolution also.

Material elementary fermions show special characteristics, such as indivisibility, energy neutrality toward the outside, self-regulation, and quantum characteristics, i.e. wave and particle nature. The recent finding of gravitational waves and the above described characteristics show that the universe shares elementary particle characteristics, leading to the fractal nature of the cosmos. Mach's principle requires independence of the choice of coordinate system. This requirement is satisfied by neither Newton nor Einstein, both of which requires very careful choice of coordinate systems and cannot accommodate the changing dimensionality of the universe. The gravitational constant (G) is determined by the universe's current physical properties, therefore must depend on the Hubble constant (Frenk & White, 2012). This hypothesis, based on static time, naturally follows Mach's principle. Position equals the local history of the field, which is highly intertwined with the energy state (the past history) of individual particles. This way all the conservation laws, such as the energy, or momentum conservation are followed. The poles opposing dynamics (white holes expanding and the black holes contracting topology) can produce expansion, whereas the great field strength of the black holes creates a pressure, which is experienced as dark matter.

The velocity or acceleration of a particle is relative measurement, i.e. it is always measured with respect to some reference frame. However, as shown, the inertial properties of a particle are highly dependent on the energy state of the background (the local field strength). Therefore inertial and moving properties of particles are interdependent, and form the basis of the Twin Paradox (Figure 7). Accepting aging as a form of information accumulation, uncovers the twin paradox as energy-information exchange. Hence, Landauer's principle dictates that age difference corresponds to energy/information difference. That the speed of aging is connected to the gravitational curvature is corroborated by general relativity. On Earth, as on any spherical body, the shortest longitudinal distance curves toward the respective pole (Figure 7). This curve is follower by air traffic and ship lines. In this vain, the shortest time is formed on a positive temporal curvature surface by an accelerating object. Hence, time dilation is a temporal path that curves toward the white hole. This numerically is expressed by the Lorentz transformation, where the inverse sine forms the azimuthal angle. Thus acceleration can be considered a curving temporal path. This understanding uncovers speed as the temporal latitude of the object. Hence, time slows down in objects with greater speed (moving along greater latitude). Because the length of circumference on spherical objects changes with the latitude, the speed of inner clocks depends on the temporal latitude. Moving along greater temporal latitude, corresponding to greater speed, slows inner clocks. In other words, speeds along greater latitude require corresponding inner clocks. Therefore, extreme speeds must be preceded by proper acceleration. However, movement occurring as part of larger spatial movement is not subjected to this limitation and can reach arbitrary relative speeds. This fact underlines the topological nature of space and the role of topology in determining the behavior of material objects, including their ability for acceleration and even relative velocity. This highly intertwined picture of the universe fits with ancient philosophical intuition and also with modern scientific data. It also eliminates much insecurity that plagues current physical theories, particularly the Standard Model. Its tenets are built on simple deduction and it takes cosmology back to the simplest physical object, the harmonic oscillator. The hypothesis inherently observes energy and momentum conservation for the largest scale of the universe. The self-regulatory ability of the universe due to spring motion leads to the natural emergence of a cosmologic evolution, which can engender complexity and biological life.

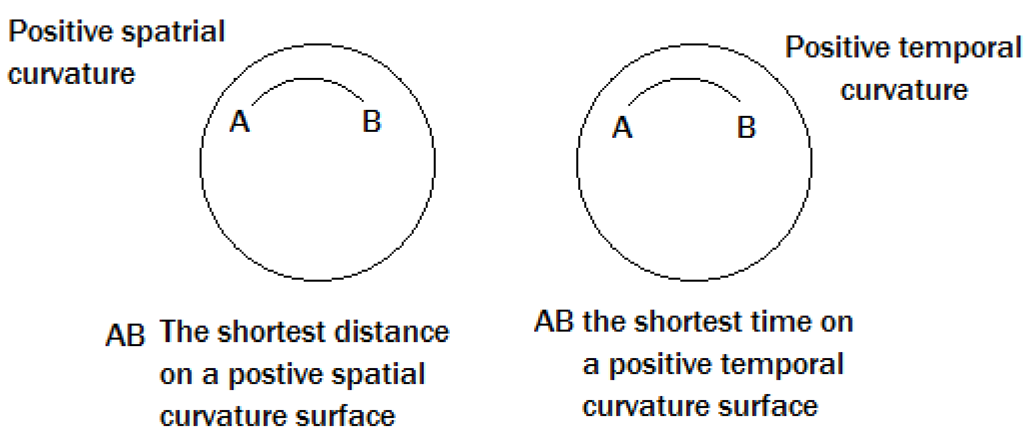

Figure 7. The analogy between positive spatial and temporal curvature. On the positive spatial curvature of large bodies the shortest distance is formed by a line which curves toward the closest pole. The same way, on a positive temporal curvature surface the shortest time requires 'temporal curving path,' which corresponds to acceleration.

Conclusions

A thought experiment inspired by some recent scientific advances, such as the experimental confirmation of the principle of static time and the Landauer's principle, is proposed. The principle of static time shows that time is a gradual evolution that forms Polar Regions. This cosmologic process manifests as a harmonic motion expressed by the Schrodinger equation, and which gradually segregates energy and information as the poles of the universe. These opposing dynamics offer an easy and natural ability to test the hypothesis by measuring the movement of metal plates placed in the vacuum, the so-called Casimir effect, within different gravitational curvature regions. For example, gravity free space should completely eliminate the Casimir effect. The gravitational curvature also corresponds to entropic differences, such as the speed of chemical processes that involves organization. Entropic differences in free space for example, would speed up the mutation frequency of microorganisms, and speed up biological aging. Measuring entropic differences will inform our understanding of evolutionary change.

Space (macrodimensions) and time (microdimensions) are two interdependent and fundamental fields that form the universe. Their contrasting changes form smooth topology between the poles, which prohibits vacuum. The smooth dimensionality changes of space between the poles (the white and black holes) engender the field of gravity, whereas microdimensions form standing waves, changing in discrete increments between the poles. Insulating the microdimensions by information blocking horizon permits quantum entanglement, interference and other quantum phenomena. The interdependence of micro and macrodimensions is the basis of a cosmologic evolution via sophisticated self-regulation. This model allows an intuitive understanding of quantum mechanics as well as general relativity, and opens a possible path toward their unification. The connection of discrete energy values with the smoothly changing spatial field leads to an uncertainty, expressed by the Heisenberg uncertainty principle. Interaction redistributes volume between the micro- and macrodimensions. Black holes form information saturated high entropy of a two dimensional horizon, which is the outer edge of the universe. In white holes space expand into the fourth dimension and give rise to new space, i.e., energy. This dimensional anisotropy determines matter distribution and inertia. Inertia is inversely proportional to the dimensionality of space, in congruence with Mach's principle. This is in contrast to isotropic models, such as GR, where inertia is invariant, not the result of material interaction. It also shows that the picture of space as a trampoline net suggested by general relativity is false. Instead, large objects contract space, causing pressure and dimensionality reduction, whereas empty space expands and develops negative spatial curvature, which would push large gravitational objects, such as the Milky Way galaxy outward. This principle also lends intuitive explanation to the existence of matter with negative mass, created in the laboratory. The simple, interconnected picture of the universe satisfies physical laws and Mach's principle. Low entropy principle, which guarantees the universe's long term evolutionary potential, results of the opposing dynamics of the universe's Polar Regions.

The hypothesis also gives an intuitive understanding of the twin paradox. The shortest distance on a positive spatial curvature of a spherical surface (such as a planet) is a path that curves toward the pole. Time is a field that also forms a curving manifold surface. For this reason, shortest time on the positive temporal curvature surface occurs via acceleration, which is a path that curves toward the polar white hole region of the universe. (Spatial expansion occurs in regions with vanishing inertia.) The differences in the pressure coming from the field strength of the black holes and the expansionary vacuum effects of the white holes creates a tensions, experienced as dark matter and dark energy, respectively. These effects could also be behind some of the experienced deviations from general relativity: for example the unexplained acceleration of satellites. The hypothesis offers an elegant solution to the problem of time by showing that time is information accumulation, which forms the universe topological surface between the poles. The opposite dynamics of the poles keeps a stable alignment, which satisfies the all the requirements listed by TelKamp on Mach's principle: 1. Inertia of a body depends on the local field strength, i.e., neighboring masses, rather than the global quality of the universe. 2. A body is pulled in the direction of accelerating neighboring masses. 3. A rotating hollow body must generate inside of itself a "Coriolis field." 4. True vacuum does not exist, because it engenders expansion. This anisotropic model, which contradicts the current scientific image of cosmos, might describe the operational mechanism of nature.

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Supporting material

My YouTube video is designed to visualize difficult concepts https://www.youtube.com/watch?v=5wMeGUP-hm4

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