MASTER'S FINAL WORK IN ADVANCED PHYSICS AND APPLIED MATHEMATICS

Title: **Multiple Time Dimensions: An Alternative to “Dark Energy”**

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ABSTRACT

The astronomical observations based on the Cosmic Distance Ladder prescribe an Acceleration in the Expansion of the Universe, unless either mass-luminosity theory is not correct, or it is considered that the time in which the speed of light is measured does not remain constant and behaves dynamically as the spatial dimensions: expanding. Thus, the relationship between both types of coordinates positive&negative, which is a hypothesis of free choice, would define the dynamics of the Universe.

Updating in a single hypothesis several alternative cosmological well known models: with additional dimensions (Kaluza), of temporary nature (Milne), in rotational dynamics (Gödel), which in the limit away from the Singularity, requires variable parameters (Dirac), all of them separately discarded by the astronomical observations. Together and properly combined, build an alternative to the Hyperinflation and Dark Energy hypothesis, which with the appropriate choice of the coordinate relationship, is consistent with the Supernova Type Ia observations and Gamma Ray Burst, GRB.

The cosmological GR equations in 5D would be undetermined, so to choose the functions that relate them, extra hypothesis will be required, such as: consistency with General Relativity, Hyperbolicity, Causality, the Cosmological Principle, Conservation of Mass-Energy, increase in Entropy and consistency with astrophysical observations. The multi-temporal formalism requires that the speed of light depends on the relationship between temporal coordinates that shapes the geometry and thus the Distance Ladder is affected by the transformation between proper and coordinated time.

With multi-temporality, Λ would be embedded in the evolution according to the GR equations and not as "addendum". A symmetry chosen between the temporal coordinates that comply with the previous "constraints", builds a temporary "hologram" that can describe within the differential geometry equations the dynamics in the Universe Expansion (including Initial Hyperinflation and Current Acceleration). The formulation of the simplest hypothesis is the requirement of a conserved quantity, and the rotational conjecture is a choice that persists degraded to obvious and direct example, because it prescribes the observed dynamics. There could be others.

If the temporal dimensions rotate, (analogy in the abstract sense, which describes a symmetry between temporal coordinates), on the spatial dimensions conserving the "temporal momentum" -which would only happen in the referred limit- (analogy in the abstract sense, which describes the conservation constraint): the Universe would be isotropic and homogeneous -in space, but not in time, always in the referred limit-; causal -in expansion do not close the CTC for the masses, but for the photons, in the referred limit-; the GR would be valid away from the singularities -the speed of light, c constant with respect to the proper time, and the gravitational constant, Λ, would be variable with respect to the time coordinate, but they would not be the reference for all the observers in every moment -.

This is not only consistent with the observations of Accelerated Expansion, galactic rotation, virial speed in the clusters or the inhomogeneities of the CMB, but also predicts several observations to be made in very distant galaxies (Z > 2), such as: "over redshift", overabundance of metals, much

larger stellar masses, more "Keplerian" curves, the low density of black dwarfs or GLMLT stars, the distribution of quasars and super-massive early black holes.

This will not be a demonstration of the existence of extra-temporal dimensions, and less of the rotation of the temporal plane, but an example that astronomical measurements do not univocally demonstrate a phenomenological interpretation of Dark Energy, integrating it into an evolution that does not have to be accelerated, but apparently accelerated by projecting on a temporary temporal manifold the proper time.

It would not be conclusive to affirm that the Universe expanded by an inflaton field or a Vacuum Energy. It is possible, only possible, that at the Beginning the Expansion was slow and is currently contracting gravitationally and that the Cosmic Distance Ladder to the coordinate time, is different if it is taken with respect to proper time. For this, it is only necessary that time has more than one dimension and thought GR equations may include then, Lambda, in its 5D formalism.

God moves the player, and the player moves the piece.

What god after what god, the play begins? "

(Borges).

PART I.

CONSISTENCY OF THE HYPOTHESIS.

Motivation and origin of the multitemporal-dynamic hypothesis. Each sub-story is consistent in itself, is consistent with the GR and with the stability of its evolution equations ... even the combination of the parts is consistent. However, each one separately has not been interpreted consistently with the astrophysical observations.

INTRODUCTION

In Physical Reality there is no a Single Story, but sub-stories with holes and duplicities, and each Truth is only true within the limits of its Paradigm. In a legal process, two dissonant narratives are built so that it is the best documented that is imposed and such is the social science mode. The best description of reality is between the two narratives that are consistent but obviously biased, to justify themselves and depends on a third party that evaluates and decide. In the natural sciences there are experts and the proof burden passes from documentation to the consistency of the story with respect to observations. This were the Classic World and a good part of contemporary science remained in those paradigms (from pedagogy to ecology). In the experimental sciences, logical and intuitive loses strength because facts, it does not matter so much the documentation, the interpretations of the data - "by experts" - or the testimonies of other authors (interpretations of the observations), but the quantification, repeatability and forecasts fitness about experiments and observations.

Each Mechanics -Classical, Statistical, Relativistic, Quantum- has its own paradigm, its set of explicit and implicit axioms, processes, approximations, rules, consensus, ... "ansatz"; and each theory is consistent -and incomplete- within its paradigm. The Theories of Unification, TOE, imply them negotiating a common paradigm to join, Physics needs a common paradigm. As for others, for Relativistic Mechanics it may imply renouncing what is not fundamental in GR, maybe as they are: reversibility, determinism, ergodicity -in the sense of Birkhoff's Theorem, time-spatial proportionality- and tighten the stability and uniqueness of the solutions, up to extreme conditions close to a singularity.

Only a generation ago, the *Cosmological Constant* was a concept side considered in the Mainstream, while it was compatible with zero. From the Lambda, Λ, of Einstein to Perlmutter-Riess-Schmidt Dark Energy, the Expansion has been assumed as a linear term added to the GR, without being implicit in the time-space geometry: an "*addendum*". It is possible to suppose that the Expansion is constant, linear, computable, ... and the Contraction complicated to a system of ten second degree differential equations, but there may be other interpretations. The observations of *Standard Candles* are consistent both with the constant interpretation of the Cosmological Constant Λ, and with its variable nature, but nothing ensures that it is so simple and independent of the geometry.

Prior development of the Combined Story that constructs the hypothesis proposed here, with its constraints or conditions that complete the definition of the "*Reverse Dynamics*" -time over space-, we will agree on several precisions of the abusive language that is going to be used, because besides the mathematical code, we will resort to acumatical concepts that strictly would not describe physics in its literalness (rotations, moments, speeds, ... temporal as abstract transformations), but by analogies (one of the 4 Aristotelian ways said valid for reasoning):

1. Dimensionality refers to a parameter space, where time-space dimensions are parameters in which the values are in a variable coordinate and it is possible to consider more, even that may not be "perceptible", for a symmetric or asymmetric dynamics, maybe as a collapsed manifold-, makes it look as geodesic collapsed at a constant value or as a brane: a force that keeps the observer confined to a manifold and therefore unable to establish

geometric relationships outside the trace, directly observable for a divine observer from a hyper-time-space in which it is embedded.

2. There are no different theories of variable speed of light -VSL-, distance-dependent gravitational constant -STM-, vacuum energy or dynamic *Quintessence*, Fine Variable Structure, α (t), ... if one is variable, they are all variable. Variability of the speed of light will not mean here that c is not constant in the time-space as a manifold 3-1, but in relation to a temporal function, whose projection -on coordinate time- is not linearly related.
3. It is not deeply known what space is, nor time, further than coordinates; but they do have a different perception for us as observers and different sign. The relationships in the variation of dimensions preceded by positive or negative signs, are a free choice of the hypothesis: a spatial dimension can vary with respect to another spatial dimension or with respect to another temporal dimension, or with respect to a non-linear combination of both. A temporal dimension can also vary with respect to a spatial or other temporal dimension, ... As a graphic visualization without pretending a strict physical meaning, in the style of using metaphors, we will speak of "rotation of temporal dimensions" as a description of the variation of a temporal dimension, with respect to spatial dimensions. When supposing multi-temporality, the evolution of the variables of a sign with respect to the variables of another sign, could configure a concept analogous to the Angular Momentum, that will be coined Temporal Momentum, if a temporal coordinate varies with respect to another coordinate space (*reverse dynamics*).
4. It is proposed to restrict the analysis to a time so distant from the Beginning, after the collapse of what we will call the axial time, until the Temporal Momentum tends to zero, ($\partial_{\psi}\mathrm{R} \simeq constant$): with an inverse rotation of time with respect to the space that tends to stop in an almost perfect radial expansion. By similarity, analog to the approximation of "weak field" of the GR, we will call "weak" -or later we will see, apparently logarithmic-, the approximation of the metric in a time far away enough from the Big Bang, attending to the limits of Spatial Angular Momentum proposed by Hawking between 10^{-14} and $7x10^{-17}$ rad/year, [1973a]. The time that we perceive as observers and that we project as a constant to a remote past, as we will see, would be equivalent to proper time in order degree < 10^{-10}.

Beyond an alternative interpretation to Cosmic Inflation and Dark Energy, although speculative, this frame 3-3 (3-2) that will be described, could also be extended to other questions, beyond the scope of this work:

1. *Convergence with the quantum paradigm*. An additional imaginary time dimension was already used by Hartle-Hawking, [1968c], to describe the Feynman Stories as a collective with some statistical distribution, with its possible formal consequences such as emergent phenomena, phase changes, percolation,... which drives to Wheeler-DeWitt to an interpretation of the Wave Function of the Universe [1967a].
2. *Convergence with string theories, quantum gravitation, ...* The 6D consideration (3-3), immediately collapsed to a bulk 5D, aids even more possibilities to more dimensions that could have previously folded, (8D multitemporal is the proposal from particles physics and also is formally adequate to investigate possible Hamilton complex algebras of 4(j) and

8(k) dimensions, which are not abelian (irreversible). 10D, connects with theories of quantum gravity).

3. *Convergence between deterministic and entropic paradigms*. The Multitemporal Hypothesis -more in the example of conservative constraint of the Temporal Moment-, offers a natural explanation to the Time Arrow and Irreversibility: coordinates of the temporal plane in rotation on a multi-space axis. There is some bibliography that conjectures about the origin of the high initial entropy, as a consequence of the collapse or folding of extra dimensions.
4. *The rotational dynamics of bodies and groups*. If the Big Bang, understood as an asymptotic process, which by our observation position seems to us hyperinflationary, has an origin as a linear isotropic momentum -a Bang-, it must contain or relate to a mechanism of transformation of a Burst to intrinsic angular moments: all the bodies observed in space rotate and orbit. If there was some kind of extrinsic moment, this ignored paradox would be truly ignored.
5. *The Initial Conditions*. The hypothesis of evolution in the "3 minutes" of the Big Bang, could be enriched with a double-or even triple- multi-temporality, which in those phases was relevant. The time $\tau(t_x i\ ,\ t_y j.) \equiv \tau(t,\psi)$, measured according to clocks of t, would transform eons in seconds when the additional time dimension, ψ, was relevant for clocks on those moments. The initial evolution usually called Big Bang, would be a boring and slow process for observers resident then.
6. *The creation of matter from energy*. Abo-Shaeer published [2001a], that the rotation of a homogeneous Bose-Einstein Condensate produces an emergent phenomenon of concentration and intrinsic rotation according to a discrete regular lattice pattern, which could be an initial conjecture to explain the spontaneous formation of matter with only using the extrinsic angular momentum.
7. *The Dark Matter*. The consideration of the restricted constants in spatial homogeneity to observers that share each time, makes it appear to be variable when measured in the past with clock, rule and balance of the present, though they are taken with respect to one of the time coordinates, t, and not with respect to $\tau(t,\psi)$. A "chauvinism" of the observer in the present and in the past, justifies the approach of models of c and G variables, such as MOND, TeVes, MOG, CTG,... (Milgrom, Bekenstein, Moffat, Fedosin,...): [1983a], [1984a], [2008a], [2009a], [2009b], [2012p], [2015a]; [2004a], [2009c], [2010a], [2011a], [2006a], [2006b], [2006c], [2007a], [2007b], [2008b], [2009d]; [2009r], [2014n]; [2012a], [2014a]; [2014b].

BACKGROUND

In 1884 Abbott published his Flatland, in a two-dimensional spatial world for which a three-dimensional being would be "divine". Mach proposed a reinterpretation of the *Clarke-Newton and Leibnitz cube*, which could be rotated in relation to absolute space and the water contained in it, as it would be a manifold, would form the characteristic curved surface: in the absence of everything else in the universe, it would be difficult to demonstrate that the cube was, in fact, spinning and the water remained with flat geometry. If another object were introduced into this Universe, perhaps a distant star, there would be something in relation to which the cube would be rotated. The water inside the cube could possibly show a slight undulation and an “chiral” observer could interpret its geometry as rotation. Causes may be external to the effects and could be observed by mortal residents in the geometry itself, if they could identify a curvature with respect to the exterior.

The first hypothesis of temporal multidimensionality comes from the attempt to explain precognition (Dunne, 1927). Bennett in 1949, to justify Free Will of a universe without *Laplace’s Demon*, proposed a universe of six dimensions with the three usual spatial dimensions and three time-like dimensions, which he called *time, eternity* and *hyparxis*. Bergson defined an *absolute* structural time, equivalent to the previous *eternity*, different from the *proper* time of Einstein. This was updated with the question: *makes sense what was before the Big Bang?*

Science Fiction adopted the hypothesis when string theories began to grow in dimensions. The Reverse Time Loop by Snegov (1977): "*My idea is to leave time unidimensional during a two-dimensional time*". Heinlein's The Number of the Beast (1980) presents a six-dimensional cosmology in which there are three time dimensions, called *t, tau* and *teh*; similar to "The Wounded Sky" by Duane, coined *beginning, duration and termination;* in Rucker's Ware Tetralogy, metamarcians "*come from a sector of the cosmos in which time is two-dimensional*" .

In the TV series Doctor Who, the "*break in time*" and the jump between the first and second dimensions are repeatedly mentioned; inside its cabin the dimensions do not share the metric with the exterior. In Interstellar a 5D resident civilization, perceives two temporal dimensions and places the protagonist in a "dimensional bubble", which allows him to move in one of the temporal dimensions, being the temporary bulk 3-2, the condition for which to modify the past, affect instantaneously to the same future.

MULTIDIMENSIONAL HYPOTHESIS

The Platonic concept -The Cave-, was updated by the theologian H. More in 1880. C. Howard targeted it as "The Fourth Dimension", when popularized the idea. At the end of the s. XIX, Zöllner translated from Spiritism into Physics the idea. The concept was taken by Poincarè, Helmholtz ... and immediately Einstein translate it on time-space. The Gauss-Bonnet Term from Differential Geometry, is non-trivial only from 5D manifolds, where derivatives cancel on the Einstein-Hilbert Lagrangian.

Nordström [1913a], [1914a], even before its definitive classical formulation, proposed a Theory of Relativity with scalar potential in a subtime-space of a greater space 5D and a century later the idea remains open, [2005b]. Kaluza proposed a cylindrical model with potential tensor [1921a], (which is the geometric equivalent to the assumption that fields in 4 dimensions do not depend on the fifth, or it is not derivable with respect to the additional coordinate, which limits the system to 15 equations). The assumptions were no-dependence -it can be interpreted physically as a collapse-, solvability, vacuum of matter in 5D ($G_{AB} = 0$, $R_{AB} = 0$)-. Since then, it has been a resource that has derived its use to the Cosmology to the Particles Physics, with its maximum development in the Theories of Strings. Einstein himself proposed formalisms in 5D, with Mayer [1931b] and years later with Bergmann [1938a].

Kasner [1921b] announced what years later it would be coined Campbell-Magaard's Theorem, [1926a], [1963a], which opened the KK -Kaluza-Klein- reinterpretation,… despite the limited success in electromagnetic and gravitational unification, (the mass of each particle depends on the collapsed dimensions diameter and predicts units smaller than the experimental ones). From then, multi-dimensionality has been a recurrent hypothesis in the description of the macrocosm, but it has never gone beyond a secondary tool, since it does not overcome the observational phase. The extradimensional hypothesis has perhaps been overused "*deus ex machina*", although less than other "dark" jokers: from the double rotational symmetry of fermions, to the problem of solar neutrinos.

General KK model:

$$R_{ab} = \partial_c \Gamma^c_{ab} - \partial_b \Gamma^c_{ac} + \Gamma^c_{ab}\Gamma^d_{cd} - \Gamma^c_{ab}\Gamma^d_{cd}$$

$$\Gamma^c_{ab} = \frac{1}{2} g^{cd}(\partial_a g_{db} + \partial_b g_{da} - \partial_d g_{ab})$$

$$\begin{pmatrix} g_{ab} + k^2\phi^2 A_\alpha A_\beta & k^2\phi^2 A_\alpha \\ k^2\phi^2 A_\beta & \phi^2 \end{pmatrix} \tag{1}$$

Being *k, curvature*
A, vector potencial
ϕ, escalar potencial

Adding a dimension is a transformation tool of a parameter into a variable, breaking a symmetry and either folding it into a scalar or adding a metric, in which case implies a distance criterion. So, if its nature were mass or entropy, you have to define distance between two masses or between two macrostates, between mass and time-space, relationships between legs and hypotenuses, ...

From Zaycoff, there has been successive attempts in the sense of adding to the 10 degrees of freedom of 4x4 symmetric matrices, with 6 more offered by the antisymmetric $G_{\mu\nu}$, [1929a]. Veblen-Hoffmann [1930a] initiated a *projective approach*, supported by Pauli, in a similar way to what it would be called later a 4+1 *defoliation*, so useful for computer simulations (with curvature, k = 0), "scalarizing" the additional dimension (denying a geometry to it through a collapse of the coordinate to a scalar). Parallelly Schouten & van Dantzig [1938b], proposed to unify electromagnetism according to a Riemannian space shared with gravity.

Particle Physics paralleled its path until it converges together. Band [1939a] proposed a 5th dimension as an explanation of spin in its 720º symmetry: a full hypersphere 5D. The projective geometry in 4D branes as manifolds from a 5D spacetime, was supported by Pais [1941a], Jordan [1945b], Thiry [1948a] and Ludwig [1951b], with various values of scalar-vector ϕ = 0, 1,... Rumer [1949b] used the resource for his *5-Optics Theory*, (updated much later by Yu-Andreev [1996a]). The idea was rescued once and again in various perspectives, like by Jonsson through decomposed 5D metric, [1951a], O'Hara [1959a] or Vos-Hilgevoord [1967b] for the *Spin-Tensor Theory*. To justify they are not observed, it was proposed the nature of the fifth dimension as else-like dimension, said mass [1975b], $G_{AB} = 0$. Later, Schmutzer reestablished the projective approximation by projected algebraic entities from larger dimensions PTUF, [2001b].

Parallelly, trying to understand the *strong nuclear force*, Veneziano began by identifying the *Euler beta function* and found particles with spin-2, which began the *Strings Theories*. Nambu-Nielsen-Susskind, developed the first formalisms with extra-dimensions and great expectations were created, but the experiments with colliders did not confirm the predictions. Since 74, Strings were re-carved recursively with theories of different dimensionality, which described the graviton and transformed the quantum-strong to microgravitational theory. From 84 *Super-Strings* converged in several models 10D, but again the confrontation with reality, relegated it.

Mathematical consistency of the compactified KK cosmologies on the strings environment, produce several cosmological proposals and more on when Schwartz-Green demonstrated the stability of the multidimensional solutions with symmetry conditions, [1984d]:

- variable dimensionality in time as a parameter, [1982c].
- creation and destruction of monopoles, [1983h], [1983i]
- scalar dimensions representing entropy, [1983j], [1983k], [1987f]
- scalar dimensions representing radiation, [1985g]

KK cosmologies nor determine geometries or geodesics and extra-dimensions were supposed to be too small, which limited to scalar collapsed coordinates over 3-1 and indirectly makes time-like dimensions a problem for Causality, so Visser proposed an additional non-compacted dimension and described it as an *exotic solution*, [1985h]. A compilation for KK solutions is attached in [1987d].

Some other solutions got photons in 4D and others a whole hierarchy of masses [1984f], [1984g], [1985d], [1988c], [1993a], [1994b], [1995a], [1996b], [1998a], [1998b], [1999b], [2006e], [2016c], but it happens that with appropriate tuning, the result is configurable and there are solutions to mathematical formalisms that are answers for convenience questions, sometimes were coined *theories of anything*. Both in the strategy of Particle Physics, the problem of observability of folded dimensions, limits the results as promising beta versions in which extra-dimensions, always compacted, [1997i].

To explain the Horizon Problem, Guth, [1981b], Linde, [1982e], [1983p], and others, developed Hyperinflationary Hypotheses. Multidimensional versions were formalized in which the compaction of some or all of the dimensions caused the expansion of others, [1983f], [1983g], [1984h], [1984i], [1985i], [1986c], [1987e], [1990b], [1990c], [1990d], [1990e], [1991b], [1996c], [1999c]. When exotic or extended extra-dimensions start to be considered in tensors, there were an explosion of conjectures and cosmological developments depending on dimensionality, [1984e], [1985b], [1985c], [1986d], [1986g], [1986h], [1987c], [1988b], [1994a]; even with cubic and quadratic curvatures, [1986e], [1986f], [1990f]

Kerner [1993d] changed "exotic dimension" to "brane": the observer would perceive the extra dimension, as a force that would tend to lift him perpendicularly. Successive waves of applications on Non Kaluza-Klein -NKK models, referred as non-collapsed multidimensionality- were used in different cosmological problems:

- scale or dimensionality itself as dimension, [1992e], [1996e], [1993b], [2011b]
- nucleosynthesis, [1992c], [1998c]
- gravitational waves in 5D, [1992d], [2005c]
- expansion or dilator fields of Dark Energy, [1996d], [1997j]
- inertia, [2010c]

In revival *Super-Strings Theories*, Witten proposed with the M Theory the unification of the 5 versions up to then with a sixth of Supergravity, transforming the coupling constant into a dimension, the one-dimensional strings into two-dimensional membranes -or branes- and keeping 6 dimensions rolled according to the constant of coupling in Calabi-Yau Manifolds, with infinity of topologies of free election. Ynduráin [1991a] proposed the proton decay as an experimental mode of detecting a second temporal dimension, in which there is no mass, but generated. Coley [1994c] tried to put order by classifying the *Compacted Classes*, that has been used in the theories of *Supergravity* with $T_{AB} \neq 0$. Even more dimensions than 6D, were added, [1992b], [2000a], [2002a], [2004d], [2006f], [2010b], [2013b], 8D, 10D, up to 21D. In [2013a], deduces concrete values of mass with only suppose rotation in an additional dimension.

Cosmology and Particle Physics follow as before, a parallel but independent path in the extra-dimensionality consideration and joined a third perspective initiated in 1951 in the hydraulic perturbation model of the Soliton by Heckmann-Jordan-Fricke, successfully exported to the analysis of stability due to disturbances of SDE's and telecommunications. From 1987, when non-linear systems can be convergent, the 5D-soliton perturbation theory for rotational singularities was developed [1987g]; either naked and cosmological, [1991c], [1991d], [1992f], [1993c]. A compilation of the different approaches from the Projective, Compactified or Soliton multidimensional perspective, up to the year 1999, is attached in [1998d].

The perturbation approaches that were used without knowing the strength of their hyperbolicity or convergence, were extended from the bibranes to the p-branes, building a new zoo of abstract structures. Since 1998, the trend changed and to justify without "cylindricality", why there are so many dimensions as parameters we need to recover a symmetry, we do not perceive them, the option "brane" no-Kaluza + no-Klein, NKK, was to extend at least some of the folded dimensions, leaving others compacted [1998e]. But if there are other uncompacted dimensions, there must be geometry, geodesics,... if they were positive, spatial, they would dislodge the orbits of the whole Universe; and if they were negative, temporal, they would close temporal orbits in CTC. So, it was assumed that instead of being compacted, they are spatial but uncoupled (completely described by the trace), remembering the cylindricality again, to avoid again the perception problems that made Kaluza-Klein think on compactification.

The concept of geodesic implies the limitation of the observer to a finite dimensionality: the observer cannot detach from his manifold or an ant cannot jump and inevitably has to follow a geodesic between branch and branch [2008d]. Some authors used Fourier analysis as an intermediate method, considering that some of the additional dimension was space-like, other time-like and other else-like, collapsed into scalars: mass at rest, entropy,... Different multidimensional NKK models have been proposed in extended branes and in collapsed branes: [1999d], [1999e], [2000b], [2001c], [2001d], [2001e], [2001f], [2002b], [2003b], [2004e], [2015d]. Compilations of decompactified multidimensional hypotheses are included: [2005d], [2005e], [2006g], [2010d].

Multi-dimensionality does not mean compactification!

ROTATIONAL HYPOTHESIS

Bianchi Classes preceded even the GR, proposing the categorization of anisotropic geometries according to their symmetry and "killing vector", which have been deeply investigated as theoretical hierarchic solutions to the Einstein equations. In 1922, Cartan proposed spatial-temporal angular momentum solutions intrinsic to the GR, whose torsion effects are well known and have been measured, (obviously the *Dragging* does not imply an extrinsic angular momentum, but the rotational hypothesis was early and thought means it is not too original). By not detecting asymmetries in space, asymmetric types have been discarded and since then the Universe has never rotated. However, the question of: *if the Universe comes from a Big Bang, what is the reason and the process of expansive linear moment transformation into the angular momentum of the stars?* Or said in another way, *why is everything in the Universe in intrinsic rotation, if it started with a radial hyper-expansion?*

The proposal of a Universe with explicit non-null extrinsic angular momentum, begins only few years later with Lanczos [1931a]. Tolman [1934a] proposed a non-homogeneous cosmology, which later Bondi [1947a], assumed to be dependent on the scale. Stockum [1936a], imagined a cylindrical solution, a thesis rescued later by Wright [1964a]. Whittaker in "Spin in the Universe" [1945a]: *Rotation is a universal phenomenon; the earth and all the other members of the solar system rotate on their axes, the satellites revolve round the planets, the planets revolve round the Sun, and the Sun himself is a member of the galaxy or Milky Way system which revolves in a very remarkable way. How did all these rotary motions come into being? What secures their permanence or brings about their modifications? And what part do they play in the system of the world?*

Gamow [1946a] conjectured that the answer to that question, was that the Universe itself was spinning and the fundamental constants are variable. In 1947 Weizsäcker used it for GR models with matter in turbulent motion. Gödel [1949a] [1951a] published a cosmological solution to the GR equations, homogeneous, non-isotropic and rotational, that had no continuity because involving non-causal-non-geodesic curves, transforming a time-like extra coordinate into space-like. Questions were then formally expressed and the path already drawn, but it was withdrawn because the lack of observations to support it, while recurrently over decades has been retaken.

$$ds^2 = (dx^2 + ke^{2mx}dy^2 + dz^2) + 2\sqrt{\sigma}e^{mx}dtdy - dt^2$$

$$-\omega^2 \begin{pmatrix} -1 & 0 & e^{\sqrt{2}\omega x} & 0 \\ 0 & -1 & 0 & 0 \\ e^{\sqrt{2}\omega x} & 0 & -\frac{3}{2}e^{2\sqrt{2}\omega x} & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix} \qquad (2)$$

Maitra [1966a] showed that non-stationary rotating models without closed CTC curves were possible,… if there is expansion, but by then this was not a nice ansatz. However, detailed observations of the Foucault pendulum with respect to distant galaxies indicated values compatible with zero. Hawking [1968a] tertiary: "*These models could be a reasonable description of the observed Universe, although the data is compatible only with a very low rotation*". A turbulent onset with rotation was proposed [1970a]. Later it was limited to decaying rates beyond 10^{-145} [1987a].

Ellis [1971a] stated that *it was not possible to unify rotation and expansion in solutions with matter.* Several arguments against were then pointed: energy-momentum tensor with several types of matter and radiation; or adding a "shear", as this hypothesis do. Ruzmaikina-Ruzmaikin [1968b], inaugurated the analysis of the solutions with various inhomogeneous and/or anisotropic versions. From there on, anisotropic models were proposed according to the Bianchi Classes, but they do not take into account the Cosmological Principle: [1969a], [1971b], [1978a]. Therefore have only persisted for models of the first moments of the Big Bang or in the vicinity of black holes (near to singularities or in the "*strong limit*" as we describe in this work), because the unappealable isotropy of the CMB limited the vorticity to at least a maximum range of 10^{-9} rad/year. Different non-isotropic models, arguments and limits, forward and against, illustrates it as a recursive non-solved question: [1970b], [1971b], [1972a], [1975a], [1976a], [1978b], [1979a], [1980f], [1982a], [1983b], [1983c], [1983d], [1984b], [1984j], [1986a], [1988a], [1999a], [2004b], [2009f], [2014c]. Inhomogeneous cosmology compilation is included in [2005a]; and an specific VSL and variable G Bianchi categorization in [2014i].

Recently proposals based on the Gödel model, have been rescued due to their ability to apply *perturbative analysis* to singularities: from this hypothesis point of view, we call "*strong limit*", close to the event horizon of a black hole. They have also been useful in their numerical simulation, taking the axis of rotation as a coordinate for a defoliation 3+1; and for being an exact solution in Supersymmetry and by extension in Superstrings. Vaidya proposed solutions in FRLW-type metrics with energy in rotation, recently updated, [2009e], [2014d]. Obukhov [1992a], for whom gravity with Weitzenböck geometry is a consequence of torsion and not the other way round, as it was considered (angular momentum gravity), transforms the stationary model into an evolutionary one, with scale factor θ (t):

$$ds^2 = R^2(t)\,(dx^2 + ke^{2mx}dy^2 + dz^2) + 2\sqrt{\sigma}\,R(t)\,e^{mx}\,dtdy - dt^2 \qquad (3)$$

There is an unappealable spatial isotropy that side those perspectives as mathematical games, while we still do not explain the asymmetry of matter with respect to antimatter and we derive the answer to Particle Physics which has shown experimentally the CPT symmetry. The emergent phenomena point to the possible asymmetry in the fractal scale and in any case, the temporal asymmetry is obvious at other scales: Entropy, [2002p].

Although spatial isometry restricts rotation, it should have left traces and any real solution should be asymmetric with expansion over time, in order to be able to dialogue with other paradigms of Physics. If a non-null extrinsic angular momentum exists, it should perhaps have leaved some residual mark on the isotropy of space, which does not have to be evident, as the angular momentum may be neglectable to the magnitude orders we are talking about. Today we identify the acceleration of Coriolis by the sense of the storms of the terrestrial surface as a result of its rotation itself, but it was neglectable for scientists until few centuries ago.

If there are astronomical clues, they are subtle. Birch [1982b] created some controversy because of supposed polarizations in binary radio sources with several supporting papers and against, [1983o], [1984c], [1986b]. Barrow-Juskiewicz-Sonoda [1983e], measured the compatibility with the isometry observed in 1.5×10^{-15} rad / year in the CMB. Meanwhile, Mandzhos-Tel'nyuk-Adamchuk [1985a], indicated a preferential orientation in a sample of galaxy clusters. Faber-Dressler described it with the expression: "*Axis of Evil*", [1987b]. Tyson-Valdes-Wenk [1990a] believed they identified ellipticity in certain galaxies consistent with their rotation with respect to a "*Universal Axis*". Li obtained surprisingly consistent results between 7 and 9% of transfer of angular momentum to galaxies if the Universe rotated, affirming that the observations deducted 10^{-7} rad/year, [1997b]. To calculate such hypothetical vorticity, Nodland-Ralston [1997c], [1997d], claim to have identified that "*Universal Axis*" ("*Maybe it was not a perfect explosion, but with a turn of space and time*"), with counter-papers [1997e], [1997f], [1997g], [1997h], arguing not to be statistically resolutive.

The polemic was improved claiming for an asymmetry in the direction of rotation of the spiral galaxies analyzed by Longo [2008c]: "*If this asymmetry is real, this means that the universe has an axis and a net angular momentum*. *For the conservation of the moment, it means that the Universe It was born turning, we cannot see ourselves from the outside, so we must assume that it rotates with respect to other universes in a space of more dimensions*". Later, Su-Chu [2009g] adjusted the Li approach to 10^{-9} rad / year, which would imply in terms of constant coordinate time scale metric, that from the Big Bang the Universe would only have rotated 1/3 of a turn.

According to the Tegmark-Oliveira-Hamilton maps [2003a], there seems to be a relative predisposition in the quadrupole and octopole of the CMB [2004c], that have been confirmed in several subsequent papers [2014e], [2015b], [2016a], [2017a]. Trujillo attributed patterns of orientation in the galaxies to the DM, [2006d]. Hutsemékers argued for a certain preference in the alignment of quasars, [2014f]. The *Dark Flow* and the *Great Attractor* [2015c] have been interpreted as the gravitational influence of parallel universes, as an indication of the accumulation of Dark Matter or as the Rotation Axis, diverse explanations that compete with more prosaic causes, such as the attraction of a hypercluster in the *Candle Constellation*. With more precise measures on the *CMB*, Feeney-Saadeh [2016b] states: "*You cannot be completely sure, but we estimate that the options for a rotation are 1 out of 121,000, which confirms the general criteria. Safe".* Greater depth in the rotational hypothesis is compiled in [2017b].

MULTI-TEMPORALITY HYPOTHESIS

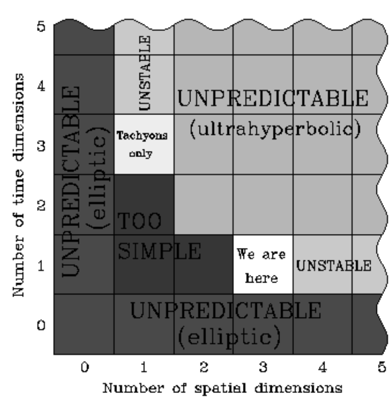
Tolman proposed non-rotational Schwarzschild-type solutions for Einstein's equations in a very massive object with 4 spatial dimensions and 2 temporal dimensions [1934b]. Milne [1935a] postulated 2 temporal dimensions at the cosmological level, in an alternative context to the GR and discarded: differentiated *atomic* and *cosmological time*, -τ = lnt-, (deducting, that both c and G should be variable as c^3 α1/G). Petrov published a classification of the algebraic symmetries of the Weyl Tensor [1954a], which has been used in Spinor Theory (NP Formalism) [1962a]. Rosen described one by one the line elements of the different NS+MT configurations, [1965a]. Later it has been used in models for multidimensional black holes (Type D), [2002d], or gravitational waves (Type N), [1994d]. Type II were also interpreted as non-linear relationships between multi-temporality and multi-spatiality, [2004f], as it is the case of the present hypothesis.

Gilbert [1956a] distinguished between *electromagnetic time* and *gravitational time*, deducting G α1/t. Apparently without considering the Petrov classification, tachyons were defined [1962b], [1967b]. Synge described a time-space with up to 4 temporal coordinates [1964c]. With not much success, Cole insisted over a 3-3 configuration, [1977a] to [2000c], as Alés did. Two-time solutions were proposed into a 4-2 configuration by Bars, -according to whom we perceive the "shadow" of the Universe-, [1996f], [1997l]. The idea is recurrent as 3-2 Schwarzschild models, [2001k]. From the purely mathematical point of view, solutions have been proposed according to the Petrov Classification in 7D, 8D, 10D (4-4; 4-3: 5-2; 5-3; 6-2; 5-5; 6-4), and even all options for multitemporal perturbations or solitons have been analyzed [2006i].

The fear to the Instability of the GR equations and the Causality, are the conditions that will lead to the observability of expected effects, to preserve the principles of homogeneity and isotropy, equivalence, verifiability, conservation,... although the price is to soften the predictability as it happens in thermodynamics, in complex systems or in the quantum and question the requirement that the speed of light is constant: not only in all space, but in all the time coordinate, always.

For the stability of the solutions, Dorling and Tangherlini-Tegmark [1997m], reasoned by the Anthropic Principle, that the only possible configuration is 3-1, since the hypothesis 3S+2T introduces a second coordinate with negative eigenvalue and transform a "well-posed" system of differential equations in a "weakly hyperbolic" system and therefore, not predictable from Cauchy's initial conditions:

Figure 1



M. Tegmark, 1997

While considering extended branes, Li [2001m] is even more restrictive and argues that two temporal dimensions are only possible in stationary models, which is the solution of elliptical systems. On the contrary, the ultra-hyperbolic have divergent evolution, towards the property of chaos that we call unpredictability, but that although it is not relativistic, it is realistic. Is predictability a requirement of reality or the slicing of the deterministic model of the GR, so that our model can work with PDE's? Is it reasonable to use at this point the Anthropic Principle, the umpteenth academic formulation of pareidolia, against Darwinism (Smolin)? The ultra-hyperbolicity can simply be a requirement of additional constraints to be determined.

The stability of multidimensional spatial and scalar solutions cannot be extended directly to temporal ones [2010f], without certain restrictions to Equivalence or Predictability, [1999f]. Sakharov [1984k] added the rotation and even proposed a specular Universe that has derived into *Jano Model*, [1995b], [2001h], [2007c], although both went on tiptoe through the problem of distances and triangles between dimensions of different nature and sign. Wesson and others insisted on a 3-2 configuration with tachyons, [1986i], [2002e], [2002f], [2003c]. Attached is a compilation of counterarguments [2002g] and contributions on tachyons, [2007c], [2012b].

Such an approach obviates the problems of brane perception or compaction because we actually perceive indeed temporal branes, [1998g], [2007f]. On the one hand, tachyons close a pathological loop with CTCs, [1998f], [2001i], [2003d], and present problems Causality, [2009h], [2013c], but in return potentiates rotation solutions if there is Expansion. In another perspective, the phantom energy modes have been opportunely rescued as a possible explanation of the Dark Energy, in its Quintessence version [2011c].

To the problem posed of the stability in the perturbative evolution of the initial conditions for additional temporal dimensions, different authors propose constraints for the consistency of the causal evolution by the temporal multidimensionality in mathematical solutions that converge, [2005g]. Craig-Weinstein, obtain strong hyperbolicity in the GR, just demanding "non-locality", which makes isotropy a requirement for the uniqueness of the solutions, [2009i]. Foster-Müller prefer to suppress the temporal moments, (which would be hardly compatible with the hypothesis analyzed here), to propose a holographic model with the second temporal dimension "thermalized", [2010i]. Velev analyzes the limitations with the Special Relativity, [2012c].

To be comprehensible and as a practical case, among the metrics that could fulfill constraints and also have possibilities of being observable, there have been proposed the wave equation propagating in a hyper-surface with uniform energy-momentum tensor (because Kovaleskaya's Theorem, can thus be factorized by Taylor).

$$\sum_{i=1}^{p} \frac{\partial^2 u}{\partial {x_i}^2} - \sum_{k=1}^{q} \frac{\partial^2 u}{\partial {t_k}^2} = 0 \tag{4}$$

The Cosmological Principle must be consistent with the Causality Principle, but considering this not as a pathology, but as a constraint: CTCs that easily arise in rotational models must be opened to prevent time travel, which forces models in non-constant Expansion, which requires a Cosmological Dynamics, Λ, could not be constant: Λ'(t) ≠ 0. In return, for the fundamental constants do not break the physics, the relationship between the parameters that make up each dimension, must maintain a coordinate relationship between them, which only in case of being linear, will result in absolute universal constants, such as speed of light or gravity.

The disadvantages and paradoxes of the multitemporal hypothesis, most of them due to the compactification point of view, [1969b], have been coined as "pathologies" and their solutions said to be "alternative cosmology". In a way, from a reasoning that combined the strong *Totalitarian Principle*, (*Everything not forbidden is compulsory*), and multi-temporality, Everett [2004g], proposed that everything that could happen, happens; which led to the first proposal of the Multiverses. There is not a set of multiverses, nor is it a single conjecture, but as many sets as each theory that proposes them needs. A taxonomy has to be made by type, [2007e]. Although it has popular success, if not by vertigo, sometimes by being contradictory depending on whether one pathology or another is to be explained, the hypothesis has remained outside the relativistic formal paradigm.

Pathology is a pejorative term that can also be taken as positive, such as limiting conditions that restrict: define. Multi-temporality has strong demands: temporal relationships cannot be linear or closed. Bona et al. [2019a] limit isotropic 3-2 multitemporal models to decelerated evolutions to hold the constraint of FLRW metric; the solutions convergence of the evolution equations; the symmetry that is lost; the determinism;... From mathematical aesthetics to phenomenological physics, to which the degrees of freedom $\partial s\phi(s) \neq 0$, pros and contras are still not clearly solved. In positive, they can be assumed as constraints: problems of observability, for "space-like" dimensions; the distances for the "else-like" dimensions; and Causality for "time-like" dimensions [2005g].

Tipler defined Closed Time-like Curves, CTC, [1974b], with counter-articles because Causality, [1994f] and paradoxes, [2002h]. Friedman, Thorne and others, investigated its hypothetical formation [2001j], [2003e], [2004h], [2005h], [2007g], also studied as "Time Machines", [2008f]. There is no need of tachyons or phantom particles and most pathologies are from the KK steady state ansatz, that solves with Expansion of non-compacted coordinates.

Churches-Kakushadze [2001l] propose models of branes-solitons in 3-2 that do not propagate tachyons, nor phantoms. Causal pathologies dissolve with open temporal curves -"unwarpped"- with only suppose Expansion also in time, [2006j], [2008g], which imposes the condition of relation between dimensions or constant coordinate velocity. Physical interpretation is the degree of freedom for a non-deterministic GR (in the vicinity of singularities). In the specific case 5D, the Ricci tensor would have the form:

$$R_{ab} = R_{\alpha\beta} - \frac{\psi_{\alpha\beta}}{\psi} + \frac{\in}{2\psi^2}\left(\frac{\psi_{,4}\, g_{\alpha\beta}}{\psi} - g_{\alpha\beta,44} + g^{\lambda\mu}\, g_{\alpha\lambda,4}\, g_{\beta\mu,4} - \frac{g^{\mu\upsilon}\, g_{\mu\upsilon,4}\, g_{\alpha\beta,4}}{2}\right)$$

$$R_{44} = -\in \psi \,\Box\, \psi - \frac{g^{\lambda\beta}_{,4}\, g_{\lambda\beta,4}}{2} - \frac{g^{\lambda\beta} g_{\lambda\beta,44}}{2} + \frac{\psi_{,4}\, g^{\lambda\beta} g_{\lambda\beta}}{2\psi} - \frac{g^{\mu\beta} g^{\lambda\sigma} g_{\lambda\beta,4}\, g_{\mu\sigma,4}}{4}$$

$$R_{4\alpha} = \Gamma\left(\frac{g^{\beta\lambda} g_{\lambda\alpha,4} - \delta^{\beta}_{\alpha} g^{\mu\upsilon} g_{\mu\upsilon,4}}{2\Gamma}\right)_{,\beta} + \frac{g^{\mu\beta} g_{\lambda\beta,\lambda}\, g^{\lambda\sigma} g_{\sigma\alpha,4}}{4} - \frac{g^{\lambda\beta} g_{\beta\mu,\alpha 4}\, g^{\mu\sigma} g_{\sigma\lambda,4}}{4} \qquad (5)$$

A detailed compilation of the multitemporal hypotheses is attached in [2010g] and [2010h].

Compiling, previous pathologies and objections made to the temporal multidimensionality can be summarized:

1. Causality. Closed curves that would not forbid the effect to condition the cause.
2. Decelerated expansion, apparently contrary to astrophysical observations.
3. Existence of unique solution with physical sense to the GR equations.
4. "Well-posedness". Different solutions for both directions of the time arrow and convergence for the initial conditions.
5. Tachyons Superluminal particles of mass to the negative square, not supported by any observation, and that also affect the causality when leaving the cone of light, [2008h].
6. Ghosts Particles without mass of negative energy that are not eliminated with the condition of transversality of the *Feynman Propagator*.
7. According to *String Theories*, the decay of a fermion is related to the radius of compaction of the dimension.

In other Mechanics of Physics indeterminacy, stochastic and the forgetting of initial conditions, are fundamental and the limitations of predictability do not make them inconsistent in their environments, but within the relativist paradigm preserves the determinism in its essence "*God do not play dice*". The different physical paradigms agree that not everything is causal; although they differ in the limitations of cause-effect relationships. Beyond the softening of the conditions of predictability to an open causality to chaos, chance and indeterminacy, open to asymmetries and ruptures in conservation laws, but in any case, any theory has to remain obedient to observability and temporal anisotropy, as rotation of all bodies, are observable.

Multi-temporality means always Expansion!

TEMPORAL 3-3 (3-2) BULK

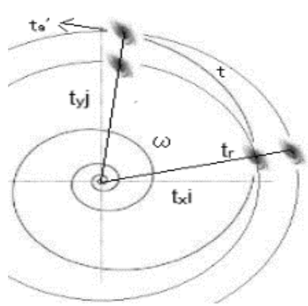
The origin of this Conjecture, could be set in the work of Novikov-Ne'eman [1964b], based on the *Kruskal-Schwarzschild solution* of the GR equations, according to which the Big Bang of our Universe is a naked singularity. The conjecture of a white hole resulting from a black hole of another Universe of more dimensions, has been recurrent since then [1991e]. It would not be a continuous function, but dependent on accretion events. By simulating the death of a 4D star, Smolin, Poplawski, Afshordi and others [2010e], [2016d], they interpret the Big Bang as the matter expelled in its collapse, as a three-dimensional *brane* around the event horizon, that expanded very slowly. A more recent approach suggests a holographic interpretation of a hyperspace universe (of 4 or more spatial dimensions), in which the event horizon of a black hole would be a 3D object.

To be inactive, without absorption of matter, charge, mass and energy, there would be conserved quantities with dependent values on the collapsed event; but if it is active, it would be information transfer, charge, angular momentum and mass, and therefore acquiring charge, mass, energy in the form of rotation and entropy (which returns us to a Dark Energy that comes from the Singularity). In such a conjecture of the process, the Holographic Hypothesis understands that if the entropy depends on the hypersurface of the Event Horizon and not on the volume, the information would lose a dimension.

Rescuing Hawking's holographic description, "*we could live in a 3-brane, which is the border of a 5-dimensional region*". With Penrose, both demonstrated that if there is a *Trapped Surface*, there will be a singularity in a finite time; though the Energy is not conserved; the Causality is not preserved (CTC's); or the GR itself is violated. By elimination, they concluded the first. If axial symmetry and Expansion, Causality, Isotropy and Homogeneity are imposed, it will be necessary to define linear relationships between the spatial and temporal dimensions -cdt-, which closes the causal curves CTC and easily concludes in stationary models without Cosmological Constant and disobedient to the Causality Principle.

Temporal expansion requires Expansion and then, if one assumes multi-temporality, the hypothesis of the relationship between time coordinates t and ψ to preserve Causality (if not a rotation will conclude in a 3-1 configuration), must necessarily be non-linear and open: in the example developed here, graphically opens a CTC to spiral. Temporal plane is structured according to t_r, *expansive time*; t_a, *cyclic time*. By requiring orthogonality, -no cross terms-, it transforms coordinates $t_r \rightarrow t_{xi}$ & $t_a \rightarrow t_{yj}$. The spiral trajectory or history, $t \rightarrow \tau(t_{xi},t_{yj}) \equiv \tau(t,\psi)$, the proper time, as reference of its constant evolution for us as observers:

Figure 2



In each temporal coordinate of the temporal plane, without this being no more than a graphic description by analogy: expansive and cyclic time, (in ADM jargon: lapse and shear), the spatial coordinate would be represented by the perpendicular to the described temporal plane, in spatial symmetry R(x), this being its degree of freedom of movement.

The multi-temporality limited by the Cosmological and Causal Principles necessarily distinguish *proper time* from *coordinated time*. If open causality curves are imposed, the coordinate relationship cannot be absolute: "*Models with Variable Constants*"; and we can prescribe an inverse dynamic in which, not being this linear relation, keep metric and coordinate relations of "c" and "G" within the "ergodicity" and the Cosmological Principle: regarding a specific trajectory of time, but not with respect both times coordinates.

The Hubble rotation tensor of such Inverse Dynamics represents a temporal expansion to which an antisymmetric tensor and a possible symmetric displacement tensor of zero trace would be added:

$$H_{\alpha\beta} = H_0\,\delta_{\alpha\beta} + \omega_{\alpha\beta} + \sigma_{\alpha\beta} \tag{6}$$

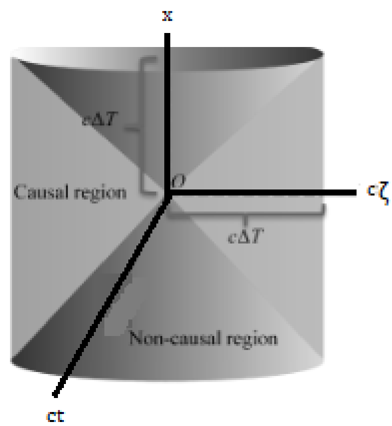
Being $\omega_{\alpha\beta} = -\omega_{\beta\alpha}$ *the antisymmetric tensor representing the rotation*
$\sigma_{\alpha\beta} = \sigma_{\beta\alpha}$ *the symmetric tensor representing the shear*
$\sigma_{\alpha\alpha} < 0.1H_0$ *as an experimental value in distant clusters*
Observations on the movement of distant galaxies limit the shear <0.1H₀, which supports the 4D Cosmological Principle -constant constants-, but allows some margin, even for not ruling out alternative relativistic models as conformed evolutions of the initial formulations of Brans-Dicke, [1961a], in which it was already taken as simplification in the weak limit $\tau(t,\psi) = cte$, *which produced* $G'(t), c'(t), \ldots = 0$.

The Narrative that completes this hypothesis is constructed from the combination of the afore mentioned subnarratives, all intertwined in an interdependent knot, which are only compatible with the observations, if one leads inevitably to the others. More dimensions means more equations, which require more symmetries to determine the system and symmetries can be expressed as Conservation Laws. So, Multi-temporality needs to add further assumptions of conserved quantities related with the relation between time coordinates t & ψ.

Expansion, Causality, Multi-temporality, Variability of the fundamental constants and Dynamics of the temporal coordinates with respect to the spatial ones act together, in conditions far from the singularity with Conservation Laws and the Cosmological Principle; or they are separately inconsistent with the observations.

For the Gödel Universe to be isotropic and causal, it must be expansive, it must be multidimensional in time and the derivatives of time coordinates with respect to space cannot be linear. The spatial coordinates will be ergodic to each other, but the temporal ones cannot be, when imposing Causality and given that the astrophysical distances from which the Acceleration of the Universe Expansion has been deduced, are measured in light-years. Time in constant expansion -cdτ(t,ψ)- would induce distances different from those that are inferred from assuming that time advances at a constant speed -cdt- of one second per second (which is no longer necessary, if there are time-like extra dimensions).

Figure 3



Causality between the cone $(x)^2 - (ct)^2 = (c\psi)^2$ *and the cylinder* $(ct)^2 + (c\psi)^2 = (c\Delta\tau)^2$*, with the condition* $|x| \leq c\Delta\tau$*:* $(x)^2 > (ct)^2 + (c\psi)^2$ *&* $(ct)^2 + (c\psi)^2 < (c\Delta\tau)^2$

Strictly speaking it is not that c has to be variable, but if it is considered in a non-constant time reference, depending on τ(t, ψ) and not on t, the speed of light would be apparently variable when measuring with respect to t and not respect to τ ... and if it is so for c, it will be apparently same for α, G, H_0 and h. Here we will try to analyze what conditions the "graph scale" that implies a hypothesis of Inverse Dynamics, on which we draw the relativistic cone, so that data does not necessarily imply that the Universe expands rapidly. If there is an alternative, it should be compatible with observations that may be interpreted as indications that in the macroscale it is possible to take other references of distances.

The third temporal coordinate would collapse almost immediately in this model and does not represent a substantial change in a development of the frame for 5 dimensions: 3S + 2T or 3-2. To discard the Gödel model, Silk [1970c], formally demonstrated that the 5D rotational models presented density instability when perturbing along the axial axis, but stabilized in the perpendicular plane of rotation: a third “*axial time*" would be unstable and would concentrate in the vicinity of a disk, folding into a small and constant value (*temporal thickness*). Analogously to galaxies or planetary systems, it would concentrate time-space in a temporal plane orthogonal to the axis: it would collapse and lose a dimension. Specifically 6D theories are detailed in [1985e].

The observation of the *Time Arrow* as a time anisotropy, points to the idea that it would make sense that in a spatially isotropic and homogeneous universe, the dimensions added to the model are negative -temporal- at the cost of admitting the possibility of inverse dynamics in temporary coordinates: time respect to space. The research group in which this work is presented, [2019a], has shown that a two-dimensional temporal universe, with limitations in symmetries and globally decelerated dynamics, would maintain in each temporary manifold a FLRW metric.

The example of transformation between temporal coordinates, which is graphically similar to a rotation in the temporal plane, will require not one, but two extra dimensions, to be completely interchangeable from dynamics of space with respect to time to an inverse dynamics of time with respect to space. Supposing a centrifugal nature of a *temporal angular momentum* (analogous to the rotational effect on the masses of air that has the Earth's rotation in the atmosphere, it should have measurable repercussions in the Universe). The collapse of a temporal axial coordinate into a disk would concentrate entropy and information, [1995c].

Campbell-Maagard's Theorem describes that any n-dimensional brane pseudo-Riemann, is locally embedded in a 5D Ricci-flat space, -a pseudo-Euclidean space- and supports the 4D solutions of the GR, [2005o]. Corollaries of the theorem, point to the generalization N + 1 with respect to N, and considered in cascade: NS + MT or N-M, with respect to NS + MT + 1 and NS + MT + 2; demonstrating that all 4D solutions to the Einstein equations can be completely embedded between a minimum of 6D and a maximum of 10D, of the parameter space and/or variable constants, [1997k].

$$N + 2 \leq D \leq \frac{N\,(N+2)}{2} \tag{7}$$

Between 6 and 10D, there is room for the parameterization of 3 other collapsed scalar constants to a flat and empty configuration (assuming $G_{AB} = 0$ in the tenth). A priori, the coordinate relationship between parameters can be scalar-scalar (compacted), scalar-vector-tensor (mixed), or fully non-compacted tensor-tensor (geometric, at least 6D in this initial proposal); and in any case it may or may not be arbitrary, from chaotic to linear, and in some dimensional value up to 10D, to become constant or null, [2008e].

Exposed in terms of Instanton: a dynamic solution in D dimensions may be stationary in D+1 ≤ 10.

$$\mathrm{ds}^2 = \mathrm{g}^{\alpha\beta}\,\mathrm{dx}_\alpha\,\mathrm{dx}_\beta\,/\alpha\beta = 0{,}123 \;\in\; \mathrm{ds}^2 = \mathrm{g}^{\mathrm{AB}}\,\mathrm{dx}_\mathrm{A}\,\mathrm{dx}_\mathrm{B}/\,\mathrm{AB} = 0{,}123{,}4 \ldots, \ldots \mathrm{D} + 1 \tag{8}$$

The collapse of a dimension, or the dimensions that in the scientific literature are identified as folded or compacted, such as the *axial time*, the *mass at rest*, *pressure* p_o, *density* ρ, *expansion energy* Λ or H_o, *entropy* S,... measures a thickness. In the particular case 3-2, the curvature scalar admits both (-, +++, +) and (-, +++, -). To compactify, its thickness value would depend on the size of the dimension $g_{44} = \varepsilon\psi^2$,

$$R^{(4)} = \left(\frac{\epsilon}{4\Psi^2}\right)\left(g^{\alpha\beta}_{,4}\; g_{\alpha\beta,4} + \left(g^{\alpha\beta}\, g_{\alpha\beta,4}\right)^2\right) \tag{9}$$

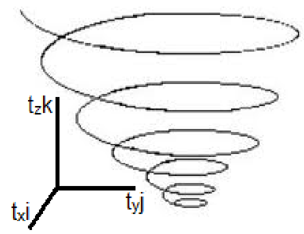
Once the axial dimension of time has collapsed, 6D → 5D, the second temporal dimension that persists, ψ, forces to define a relationship with the other coordinates in the matrix that describes the geometry of the manifolds... and the solution of the linear coordinate relationship g_ψ = cdt, -diagonal, in which the proper time is equal to the coordinate time-, is incompatible with the temporal rotation: except if when taking the "second temporary collapse" as a "temporary shift", it tends to zero and the rotation is considered negligible, which is different to be null, because according to the conditions of evolution, at some time in the past it must have been relevant, and that is precisely what we may be measuring in the brightness of the supernovas Ia and GRB.

The present Hypothesis proposes the analogy of a universe of at least 6 extended dimensions, crushed almost immediately to collapse in a temporal plane and postulated from an existence represented in its beginning by 5, but limited to 4 when gradually collapsing for the second time a temporal dimension, in a more deliberate and progressive way, when it moves far away in the time from the Singularity event, and it is analyzed by observers with conceptual capacity of representation in 3 dimensions, on a 2D paper, [2006h].

A circle orbits on a point, a sphere on an axis, a hypersphere of 4 dimensions, on a plane at 720º, and if it has 5 dimensions on a 3D volume. Point, axis, plane and volume are necessarily still, when turning over them and they are isotropic as axis, but not for expansion coordinates with the asymmetric temporal dimensions. The spatial-temporal dynamics describes the relationships between spatial coordinates with respect to temporal coordinates, but a temporal-spatial inverted dynamics would also be possible.

For didactic purposes, it has been relatively common in the scientific literature to propose options in which the spatial dimensions are reduced from 3 to 1, leaving a descriptive "toy model" 1S + 2T: [1994e], [2001g], [2002c].

Figure 4



For the particular case D = 5, to which this example is reduced, by calling the second temporal coordinate as ψ, or *cyclic time*:

$$\mathrm{g}^{ab}\, \mathrm{dx}_a\, \mathrm{dx}_b \;=\; \mathrm{g}^{\alpha\beta}\, \mathrm{dx}_{\alpha} \mathrm{dx}_{\beta} \;-\; \Psi^2\, d\psi^2 \quad / \, ab = 0{,}123{,}4 \tag{10}$$

Thus, in order to specify the rotational example, a temporal evolution with respect to space will be proposed, which will naturally lead to the successive collapse of the fith dimension, perhaps observable, of the added temporal dimension ψ, τ(t, ψ) → t. Then, the coordinates t and ψ are still different, but t >> ψ in eras far from the Beginning, maintaining an observable difference, perhaps after the CMB, which would increase in the look back time (LBT):

1. *First Temporal Collapse*. If we considered a 6D model (3-3 or 4-2), a meta-time-space in temporary rotation would "crush" on a flat disk (3-2), 3S being the symmetrical dimensions at the axis and the 2T asymmetrical evolving on a temporal plane. Analogous to the plane of rotation of the Solar System or the Milky Way: it loses a spatial dimension, (it does not cancel it, but it takes a constant thickness and makes it very close to the Singularity).
2. *Second Temporal Collapse*. It could be described by a history or trajectory according to a time-like spiral. Didactically simplifying a single spatial isotropic dimension, as the axis on which a particle rotates in a plane of two temporal anisotropic dimensions-, τ(t, ψ). Limiting the uniqueness of the dynamic system, the spiral modelling prevents the crossing of trajectories except in a fixed point or asymptotic naked singularity, with which the Expansion also limits the chronology in what has been coined Block Universe [2005f], justifies that c cannot be exceeded and avoids the objection of the Causality of the dynamics by not closing the temporary curves, CTC.

It can be striking to assume multi-temporality 3-3, to immediately evolve it in two successive steps next to the Big Bang, to 3-1 and remain the same that we have in standard cosmologies, but it will be seen later that the consequences of such evolution would leave an imprint in the chronology, when before now a days that $t >> \psi$, both coordinates were relevant and that would be perhaps astronomically measurable.

With certain symmetries, Bona demonstrated that a bulk 3-2 would preserve FLRW metric in a non-accelerated Universe (we will see that Acceleration is one of the possible interpretations of the astrophysical data), [2019a].

Relation between two-time coordinates is always not linear!

VARIABILITY HYPOTHESIS

In 1784, Michell sent a letter to the *Royal Society* entitled "*On the means of discovering the distance and magnitude of the fixed stars, in consequence of the diminution of the velocity of their light, in case such a diminution should be found to take place in any of them, and such other data should be procured from observations, as would be necessary for that purpose.*"

To explain supposed anomalies in the curvature of the light by the mass of the Sun with respect to the forecasts of the GR -which was later attributed to other causes of solar hydrodynamics on the surface-, Jordan proposed the first version of the scalar-tensor theory [1938d]. Dirac [1937a], [1938c], states: "*It is assumed that the laws of Nature have always been the same as now*", thus he questioned the constancy of G (LNH), and following much-discussed reasoning about his conjecture about Large Numbers, he proposed it inversely proportional to time. Chandrasekhar [1937b] and much later Gamow [1967d] took the proposal seriously. Brans-Dicke developed a cosmology with variable G, [1957a], -up dated on [2009k]-. Hoyle-Narlikar, [1964d], proposed G as a function of density. Shlyakhter opposed to such possibility, [1976b] and start analyzing the radioactivity of the Oklo site, as Teller [1984b] or Zwicky himself supported. A compilation of the controversy is attached in [1981c].

Even without rotation, under isotropic conditions, the variability of the constants can be a consequence of the scalar multidimensionality, [1980e]: such is the case on *Superstring Theories*. However, there has not been further experimental evidence comparing frequencies in atomic clocks, nor observational decreases in the rotation speeds of the orbital decays (LLR, with mirrors on the Moon), nor of temperature increase (if the luminosity depends on G, a few hundred years ago the temperature of the oceans would have been boiling). The controversy remains unsolved [1974a], [1977b], [1985k], [1987h], [1996g], [2006l], [2007i]. From same Oklo data, Lamoreaux-Torgerson, [2004m], deduced for almost 2 billion years ago, a value $|G'/G|$ of 4.5 parts in 10^8, with margin of error of 20%. If such a variation of the constants existed, it would be subtle, [2003h].

When the conservation of isotropy and homogeneity is imposed, variability of c and G reappear as an alternative to the explanation of Guth [1981b], or Linde, [1982e], for the Horizon's Problem: Petit proposed with variable light velocity as an alternative, [1988f], [1988g], [1988h], [1989a], [1989d]. Cosmologies without fundamental constants solve the Horizon Problem, [1993f], [2002k], [2003p], [2012q], but they inevitably require multi-dimensionality in a loop with constants variability, redefining them as coordinates:

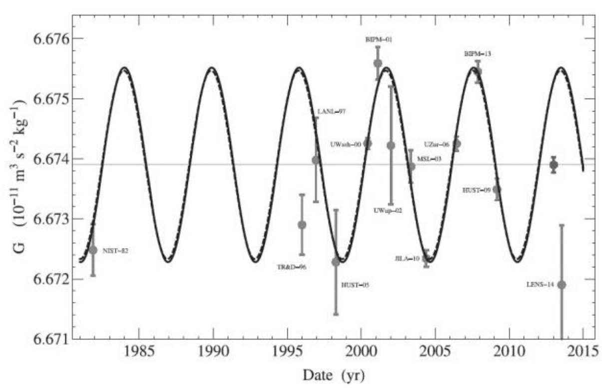
- Variable gravitational constant, G, [1988j], [1996i], [2016e]
- Variable cosmological constant, Λ, or variable Hubble Constant, H_o, [1990j], [1992g], [1995d], [2014m], [2016f]
- Variable Fine Structure Constant, α, [1988i], [1998n], [1999j], [2001n], [2001o], [2001p], [2004k], [2004l], [2005j], [2009j]
- Variable Speed of Light, VSL, [1998h], [1999h], [1999i], [1999k], [2000d], [2000e], [2000f], [2003f], [2003g], [2004i], [2004j], [2005i], [2006k], [2007h], [2008i]

The constancy of c, G, H_o, α, h, ... is for all or for none of them, [1986j], [1988d], [2002i], [2002j], [2003f], [2014g]. A compilation of the different approximations to the variability of the constants is attached in [2002m]. A compilation in divulgative book format of Magueijo, is attached in [2003i] and mean while the controversy follows in the next years up to our days.

G can only be decreasing if the Universe is in a decreasing expansion, which is consistent with the same requirement from the multi-temporal hypothesis. Since the first versions of string theories, the dilaton mass depends on the radius of the compacted else-like dimension, in which its dynamic promotes the Planck Mass to be variable, M_h, and consequently also to G. From Statistical Mechanics, some proposals of gravity as an emergent phenomenon also leads to a variable G, [2017c].

From Cavendish to Eötvös, there has been recurrent interest in measuring the equivalence between gravitational mass and inertial mass to ever smaller precision. Both to verify or falsify the Conformal Hypothesis, as well as quantum gravity. There are groups in Russia, New Zealand, Germany and the USA competing to measure G to a higher precision, and they do so in a range of between -0.1% and +0,7%. Different methods are by effects on the celestial and stellar dynamics, in the reflection of radio signals on Venus and Mercury, in luminosity, in the rotation of binary pulsars, in the variability of the Hubble constant: if G is variable, it is at a level below 1% in the last billion years - $|G'/G| <(10^{-11}-10^{-12})$ annual-, or compatible with zero. Not only the precision of those measures of G in Oklo, beyond a 1% in the last billion years, are compatible with zero on the astronomical scale, but there must be further theoretical precautions, [2001q]. In [2015e], measurements are collected according to 13 different groups on different dates:

Figure 5



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Following the aforementioned "scalarization" of the additional dimensions for NKK solutions, Conformal models began to proliferate, [1990h] especially at the astronomical scale: Milgrom, (MOND) [1983a], [1984a], [2008a], [2009a], [2009b], [2012p], [2015a], with its relativistic extension, Bekenstein (TeVeS) [2004a], [2009c], [2010a], [2011a]; Moffat, [2006a], [2006b], [2006c], [2007a], [2007b], [2008b], [2009d], [2009r], [2014n], (MOG / STVG); and Fedosin, [2012a], [2014a], (CTG). There is a hudge variety of postnewtonians theories with variable G [2014b], to explain the anomalies in the rotational velocities of the galaxies and viral velocities of the clusters [2010j], [2011d], [2013d], [2016g], [2017d]. MOG has even been used for black hole simulations, [2014o], [2015k]. The references are too extensive, despite its minority and they represent a solid alternative to the "Dark" and "Inflationary" hypotheses: [2005k], [2009l], [2011e], [2012d], [2016h].

Similarly |c'/c| is limited both by observational measurements and theoretical precautions [2007j], and they are compatible with its invariability up to error margins of 3.2 10^{-11} per year. Measuring the speed of a laser in its round trip to the Moon since 1970, when they left a reflecting mirror on its surface, Sanejouand, [2009m], claims a decrease of up to 3 cm/sg, yearly, consistent with the previous limit, to which other authors reply that it may be due to the change in the semimajor axis of the orbit (in return, he replicates with ephemeris of historical eclipses that do not show this effect).

If G variable, the Planck Mass M_h is also variable, as it was intended when defining the dilaton [1972b], hypothetical particle associated with a scalar field of the multidimensional theories else-like. Kaluza & Klein related the coupling constant with the gravitational constant according to the inverse of the radius squared of the extra dimension as, $\alpha \approx G/Я^2$, though if G is variable, so must be any collapsed thickness.

Bekenstein questioned the Fine Structure Constant -α-, [1982f]. It is been tried to verify this hypothesis through the constancy of the Fine Structure Constant -color spectrum- with data from DEEP2 experiment [2005l], compatible with 0 from Z = 0.7-0.9. Between 1997 and 2011, several controversial analyzes have been published on the absorption of photons from quasars by metal atoms in gas clouds, which suggests that the effect exists, although so slight that it would only be evident for high Z's -Δ1/100,000-, which curiously is in the same order of inhomogeneity in the CMB, and also with indications of laterality, by varying differently according to the direction on the sky in which it is measured. There are doubts about the effects of powder diffraction and there are many papers and counter-papers: [1998i], [1998j], [2000g], [2000h], [2001r], [2002l], [2003j], [2003k], [2005m], [2011f], [2011g], [2014j], [2015f], [2017e].

Anticipating the return of exile from the Cosmological Constant, possible minimum values were proposed despite being compatible with zero: [1984l], [1987i], [1987j], [1988l], [1988k], [1989b], [1990i], [1992h], [1996j], [2001s], [2012g], [2012f]. The so-coined *Hidden Principle* proposes that "*Any measurement that is sufficiently close to zero or one, it must be zero or one*", but thanks to not being taken as a principle but for prejudice, gravitational waves have been detected, the mass of the neutrinos measured or confirmed the Cosmological Constant itself. With the evidences of Riess, Perlmutter and Schmidt, [1998k], [1999l], [2003l], [2004n], its existence was confirmed, although not its variability, and part of the Scientific Community points to the possibility of a Λ(t) time-dependent, [2008j], [2008k], [2013e], mainly to give consistency to the computational models of Galactic Genesis. The Λ-variable-multidimensional hypotheses are diversified in the "Extended Inflation Models" family, which Ponce de León, classifies in 8 scalar and factorizable types, [1998m], [2002n], [2003m], [2008l]. Once again, as in the rest of the subnarratives used up to now, a compilation is attached as a report format of the published investigations, in [2015g].

Multi-temporality necessarily means variability of fundamental constants!

FRANKESTEIN HYPOTHESES

Such a combination was early and Rosen applied multidimensionality to gravitational waves rotating cylindrically in a spacetime 6-4 [1954b], [1973b]. Multidimensionality and variability of the speed of light and Dynamic Cosmological Constant, also had been combined on the scientific literature: [1983m], [1984m], [2000j], [2001t]. In the following 20 years there was a profusion of proposals from 5 to 10D, multitemporal to 5-5 [1963b]. Less frequent but still, is to join rotation, multidimensionality, variability of the constants, at the same time. In this context, the combination of the previous groups of partial substories is formalized from *Campbell's Theorem* (a compilation is attached in [2000i]).

Edmonds proposed a 5D cosmological solution in rotation, [1974c]. Andrianapoli [1999m] and Rebouças, [1998l], [1999n], propose rotational (4-1= 5D) models adding expansion, that we could call on their authors' backs, *Einstein-Kaluza-Gödel-Dirac*. Multidimensional-Gödel models are characterized by its anisotropy and/or the transformation of constants into variables: [1982g], [1983n], [1987k], [1997q], [1999o], [2000k], [2012h], [2013f].

Supported by the practical successes of the Numerical Relativity, combined solutions of multi-temporality, rotation and variability of constants, have been rescued to be used close to the "*strong limit*", as hypotheses that are currently valid for galactic genesis around macro-singularities, [1986k]; stellar black holes, [1985l], [1986l], [1987l], [1988n], [1995f], [1999p], [1999o], [2007k]; even with variable constants, [2001v], [2002n], (while other deny the possibility, [2003n]); wormholes, [1993g], [2001u], [2009n]; and perturbative models such as dilatons-solitons, [1995e], [2006m].

The next step should be the application of this not very new strategy to the proximity of a Naked Singularity, and the only one whose possible existence we know is the Big Bang. When passing it from the gravitational environment of a great mass of attraction, to a cosmological event of a great repulsion, one would have to question the Cosmological Principle, and even the GR itself, unless the additional dimensions are temporal, with different possible hypotheses that displace the anisotropy at the time, (beyond its Horizon of Events, the sign of the dimensions can change, so that in that limit, it is natural to suppose inversions in the spatial-temporal dimensional nature), [1996k].

Wesson, [2002o], with a non-compact second temporal dimension, τ, proposes an exponential solution:

$$0 = dS^2 = \frac{\tau^2}{L^2} ds^2 + d\tau^2 \rightarrow \tau = \tau_0 \, e^{\pm i (s - s_0) \cdot L} \tag{11}$$

Raeymaekers, [2011h], adding the rotation, although stationary -without expansion- and with constants, in a "toy" version 1-2, proposes a metric as:

$$ds^2 = d\rho^2 + g_{tt} \, dt^2 + 2 \, g_{\psi t} \, d\psi \, dt + g_{\psi\psi} \, d\psi^2 \tag{12}$$

Thus, so much documentary effort to confirm that the proposal to transfer these multitemporal-rotational approaches from the dressed singularities, in which they are used with certain assiduity, to the naked singularities, is not a novelty. A hypothesis solidly documented by parts, such as the one presented here, while lacking a story consisting of the Primordial Singularity, is even so unoriginal and outdated, as the imposition of constraints or conditions of a metric restricted by Isotropy, Stability, Causality, Conservation, Locality and Chronology (to preserve a unique time trajectory, [1992i], [2004o]).

In this line, here the electricity is replaced as Shelley's novel, which was collected from the lightning in a storm to give life to a set sewn of dead parts, by a unique consistent story-telling, in which it deduces a dynamic model by approximation with constant Λ -Einstein- of a rotational model -Gödel-, in 5 dimensions -Kaluza-, at least two of them temporal -Milne-, with variable constants -Dirac- and compatible with the observability... Sided narratives, resurrect together in a hypotheses by combination of discarded theories, with the glue of laws of conservation, adding the multi-temporality next to the singularities to export the model to the Big Bang.

In fact for the academic consensus, homogeneity and isotropy, the own validity of the GR, the sign of the dimensions, the variability of the constants or the conservation of the energy, are doubts in the vicinity of a singularity like the black holes or the Big Bang; and it is often stated that in such extreme conditions, *there are no laws of physics*. Yes, there are, but we still do not know them.

Constant variability can be an alternative to Multiverses, Cosmic Inflation, Dark Matter and Energy!

LAMBDA GEOMETRIZATION

It is often argued against multidimensionality: if there are more dimensions, why do not we perceive them? What observation or experiment supports such a hypothesis? The ants live in a brane, 2-1, because they cannot jump like spiders do, who believe they live like us in a holographic brane 3-1. Assuming that his walk on a flat spacetime is inertial, the ant will measure a z-coordinate as work, an additional dimension for its scope of Equivalence, which he does not perceive as the degree of freedom -the spider does-, but as the amount of calories needed to climb a hill with respect to walking on a plane. A geodesic bridge of ants that joined two branches would be a flat space for them but a catenary in space D+1, for the spider. An observer in an elevator or a crazy ant climbing a slope that formulated a 4D GR, would take $G_{AB} = 0$, but $G_{\mu\nu} \neq 0$. The spider would do the same with one more dimension.

The limitation in the dimensional perception of a *Holographic Universe* is implicit in a level as fundamental as Geometry itself and from the perspective of this hypothesis, it is precisely the concept of embedded dimensions, which describes the *Weak Equivalence Principle*: we perceive the movement by the geodesic in an indistinguishable way to the gravitational mass (geodesic observers, Euler-objective or subjective), but conditioned to be limited by the cross terms of the matrix that describe geometry. We perceive the time in geodesic way by a squished two-dimensional temporal brane and we perceive it as directional because it is in asymmetrical expansion. We do not remember the future and the argument "*if there are more dimensions, why do not we perceive them?*" does not make sense, because we do it: as variable parameters that express the potential energy, the entropy or the Time Arrow.

A multidimensional hypothesis increase the size of the differential equations system and though either underdetermine the solution or either need more constraints. Extending the Friedmann models to 5D, either the Energy-Momentum Tensor is replaced by a *conformed dimension* else-like, equivalent to a variable parameter of the mass and an empty de Sitter configuration is assumed in a greater dimensionality; or a hypothesis with ligatures that define the relation between time coordinates is defined. In this work we have opted for the second option and an example has been developed in which the constraint is the conservation of a specific quantity, coined *Temporal Momentum*, which represents the area swept by the orbital trajectory of the proper time, $\tau(t,\psi)$. There could be other more intuitive examples, but with this simplification we will see later, that the observed astrophysical data are reproduced.

To embed the evolution of the expansion in the differential geometry as the evolution of the contraction, a multi-temporal model requires additional constraints and as we already know, non-linearly relates t with the added temporal coordinate, ψ. Generically the mathematical framework of the line element of the temporal plane which represents those concepts on a time-space 3S+2T, or 3-2, with orthogonality, temporal symmetry and still without defined constraints that determined the non-linear relation between time coordinates, would be of the form:

$$dS^2 = -A^2(t,\psi)\, d\psi^2 - N^2(t,\psi)\, dt^2 + R^2(t,\psi)\, \lambda_{\alpha\beta}\, dx^\alpha dx^\beta \qquad (13)$$

The method will be to arrange these conditions for a 5D, 3-2, Universe with constraints that defines the inverse dynamic rotational hypothesis, proposed as a law of conservation, and therefore asymmetric and non-homogeneous in its origin and end, in approximation "*far away* *from the Singularity*" -with a negligible rotation rate-. With appropriate symmetries, the solution compatible with the homogeneity and isotropy of the FLRW, although for CTCs to be opened with anisotropy and expansion in the temporal plane. The starting hypothesis would be a metric such that $N^2(t,\psi)) \rightarrow c^2$, the standard line element would be folded canceling the non-diagonal terms and relating the temporal coordinates as inverse evolution:

$$A^2(t,\psi)\, d\psi^2 = -\frac{1}{R^2(t,\psi)}\, d\psi^2 \tag{14}$$

$$ds^2 = -\frac{1}{R^2(t,\psi)}\, d\psi^2 - R^2(t,\psi)dt^2 + R^2(t,\psi)\, \lambda_{\alpha\beta}\, dx^\alpha dx^\beta$$

From Superstring Theory, a Universe described by R_i of 6 collapsed dimensions, is equivalent to its dual Universe, described by $1/R_i$: length by width. Similarly, dimensional collapse can be physically interpreted from a multitemporal metric, T_{i-1}/T_i, as dual from a rotation. Why propose such a more complicated metric and apply it in its "*weak limit*", to simplify at the same 4D projection by increasing R(t,ψ), which is equivalent to saying "*move away from the Singularity*", as well as saying "*approaching a singularity*" -1/R(t,ψ)-?

In the process that takes us from an asymmetric configuration to a projected FLRW metric, we will see that what changes is the scale of the axes on which the same space-like/time-like reference system is drawn, - $c(t,\psi)\, d\tau \rightarrow c\, d\tau(t,\psi)$ -, being able to choose a coordinate system such that the spatial ones are diagonal and the temporary ones (t,ψ), related to each other by a transformation that represents the evolution of the temporary anisotropic variables, conserving a quantity of rotation.

$$\textit{Expansion factor}\ \theta(\tau) = \theta_o\,(1 + H_o\,(\tau - \tau_o) - \tfrac{1}{2}\, q_o\, H_o\,(\tau - \tau_o)^2 + \cdots)$$

$$\theta_o/\theta(\tau) = 1 + Z \tag{15}$$

$$\textit{Ligth Distance:} \qquad D_L = c/H_o\,(Z + \tfrac{1}{2}\,(1 - q_o)\, Z^2 + \cdots) \tag{16}$$

"A priori" the chosen example of a time-reversed dynamic conserving the energy-mass, may be counterintuitive, even with the simplest symmetry model that can be drawn: a hypersphere 1S+2T, 1-2, in which the spatial coordinates are the axis over the temporal coordinates rotate. For simplicity at the cost of being physically arguable in its nomenclature -temporal momentum-?, the proposal is to consider in this introduction, the following hypothesis:

A Universe with non-null extrinsic Temporary Moment, in which the anisotropic vectors on temporal dimensions rotate over the isotropic coordinates, in a time-space of at least six dimensions, with the same proper speed and different coordinate speed of the light measured by all the observers, each with its ruler, clock and balance, constants in space and variable in time according to the speed of rotation and keeping the Temporal Momentum.

An alternative 5D metric, which may be useful in the "*high energy scale*" -who knows if even before the Transparency or beyond the Event Horizon-, is simplified in the "*weak limit*" on a spherical hypersurface by rotating axisymmetrically over a spatial volume of 3 dimensions (1 isotropic in this simplified visualization), and maintains the local value of c coordinate and absolute equivalent, provided that rules, clocks and balances, are useful only for local observers: the projection $\tau(t,\psi) \rightarrow t$.

A local observer does not measure with the Mercator projection a distance in the Sahara with the same rule as in Greenland. To be consistent, not just the size of the rule may change, but also the scale. If the Tuareg uses his Mercator-rule to size Eskimos, there will be an error. The metric ruler of space behaves in its coordinate expansion, identically to the metric rule of time or clock. In such dynamics, by the metric property of constancy of the speed of light in vacuum, or $dt \alpha dx_n$, c is the coordinate speed of the light (coordinate distance vs coordinate time $dx/d\tau$), and it does not have to coincide with the proper speed of light (metric distance vs proper time dx/dt).

Because of the limitations of reductionism itself as a strategy, neither the verification of the full set of conjectures of Einstein, Gödel, Kaluza, Milne, Dirac and Novikov, implies the authenticity of each one separately; nor the non-verification of each one separately, nullifies the possibility of its joint verification. In any simulation, and theories are always simulacra, the arbitrariness of the constants represents the distance between the model and reality, so a geometric theory with variable constants and irreversibility, at least aesthetically, is worthy of being developed just because only that reason. "*Whether they are or not and why constants are constant is one of the most interesting questions that can be asked*" (Einstein).

Rotation is an additional hypothesis to determine an underdetermined Multi-temporal system, but Multi-temporality do not implies rotation!

PART II.

DEVELOPMENT OF A CONSERVATIVE HYPOTHESIS FROM MULTI-TEMPORALITY AND VERIFICATION WITH ASTROPHYSICAL AND COSMOLOGICAL OBSERVATIONS.

Reformulation of the hypothesis, taking as a starting point the multi-temporality, to combine the previous subnarratives in an approximation in the "weak limit", that prescribes the observed dynamics and that result to be equivalent to the particular case of the rotational postulate.

HYPOTHESIS

Rotation needs Multi-temporality, but Multi-Temporality do not necessarily needs a rotational symmetry and more than this, it is more generic and it do not need constants to be fundamentally variable but only apparently variable. With this perspective swift, rotation will play the role of symmetry example postulate. Restart again the Conjecture substituting the rotational point of a black hole from another bigger dimension Universe, that forces the multi-temporality, for the multi-temporality in a bulk 3-2, without white hole, without rotation and therefore without choosing specific relation between time coordinates. Homogeneity, Isotropy, Causality, Chronology, Stability, Locality, Expansion, as constraints will force by themselves to an underdetermined equations system in which there is room to postulate some Conservation Law or Symmetries to get a solution. This free choose postulate will necessarily define dynamics in the fundamental constants that may be observable.

Hologram of the 3-2 bulk would be the time-space manifold 3-1 as a projection on ψ = cte, for which the rotational hypothesis from a *white hole* is only an example of, in this case, inverse dynamics. With the postulate of an additional temporal dimension, ψ, embedded according to the formalism of *Campbell's Theorem* in a pseudo-Riemannian spacetime [2019a]; the coordinate variability of the constants, the expansion, the non-linearity of the relation between times and the need for conservation laws, will be unavoidable. Not so the rotation, which will only be a choice of the relations between the evolution of the temporal coordinates, so that a solution is determined, but others can be postulated.

Analyzing Schwarzschild's solution, Kasner [1921b] proved that a N-dimensional vacuum solution that was not flat could not be embedded by a flat spacetime N+1, but it could be into a N+2 hyper-space. In 1933 Roberson limited the isotropic metric to an embbeding class-one, but certain symmetries make superior orders possible, [1999p]. Although sparingly, this bitemporal isotropic class-two approach, or even superior, had been previously analyzed by Andrianapoli-Rebouças in [1999m], Ledesma-Bellini [2004p], Burakovsky-Horvitz [2011i] and Akbar [2017f], for specific situations.

A model 3-2 will be isotropic and homogeneous embedded class two, also if there are constant relations of the expansion of its dimensions, $\partial_R t = \partial_R \psi$, but then with only an axis rotation on the temporal plane, the solution becomes 3-1. In this isotropic holographic model, each manifold 3-1 of the hyper-space 5D, maintains both temporal coordinates related by a function that introduces the expansion dynamics in the geometry itself, inverting the role of time and space in the equations. This implies not only to consider Lambda, Λ, inside the Geometry, but also a great freedom in the choice of the function that describes the evolution of the Universe, to adapt it to available astrophysical data. Given an observed evolution in the Expansion, only by adjusting the relationship between the evolution of the temporal coordinates, Dark Energy could be expressed with a consistent system of equations joined to the Gravity.

Up to here, the line element of the metric has been a hitherto a hypothesis for the projection on the expansive time to be equivalent to a time-space 3-1, only when the *cyclic time* was negligible. Bona et al. [2019a], generalizes that same metric as a direct consequence of any temporal symmetry and as a consequence, offers a way to embed any hypothesis of expansion within the equations of the Relativity in 3-2 dimensions, but it has cost in constraints: deceleration and coordinate variability.

By analyzing in detail the reasoning that an additional temporal dimension would maintain the isotropic metric in the spatial coordinates, such a statement is true not only if the evolution manifolds one coordinate over the other, -as the line element, originally proposed as conjecture, prescribes -, but for any relationships between temporal coordinates, which is a generalization for any hypothesis of symmetry between coordinates of negative sign. Any dynamics of the Universe that describe the observations, would be representable in a system of differential geometry equations, being able to include in them from the Initial Cosmic Inflation, that is supposed to justify the *Horizon Problem*, to the *Acceleration of the Expansion*, which is supposed to justify the observations of the distances of the Standard Candles and the Gamma Ray Burst intensity (GRB). The Inflaton Field [1994g], or the Dark Energy would not be added terms to the equations, but implicit in them and would evolve in coordination with the gravitational dynamics.

The most trivial example is the projection on a second temporal coordinate in constant surfaces, which would result in the expected FLRW metric for a pure radiation Universe:

$$ds^2 = -d\tau^2 + \tau\, \lambda_{\alpha\beta}\, dx^\alpha dx^\beta \tag{17}$$

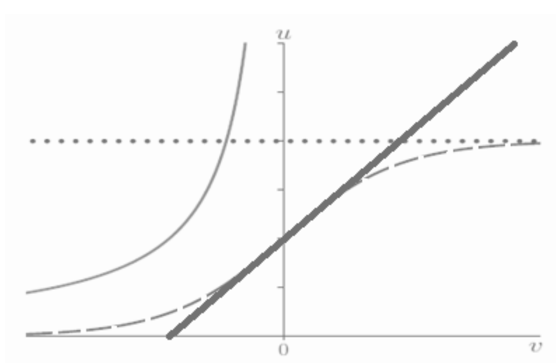
Other examples arise from testing models of Universe with an Asymptotic Beginning (without Big Bang), Hyperinflationary Start (without Horizon Problem), with acceleration (open), with a preponderance of gravitational action (closed), cyclical, chaotic (emergent) , ... The use of the Multitemporal Metric allows translating any hypothesis that fulfills a condition of temporal symmetry, in a formal geometrical proposal in accordance with the Cosmological Principle. Then, the observational description proposes a symmetry relation between the temporal coordinates, which remains to be interpreted physically case by case according to the transformations of coordinates u and v, such that

$$\frac{\partial u}{\partial \psi} = -R^2 \frac{\partial R}{\partial t} \ \& \ \frac{\partial u}{\partial t} = R^2 \frac{\partial R}{\partial \psi} \tag{18}$$

Taking the $R^{(3)}$ harmonic spatial coordinates:

$$\frac{\partial^2 R^3}{\partial t^2} + \frac{\partial^2 R^3}{\partial \psi^2} = 0 \ \Rightarrow\ \mathrm{R}^3 = \mathrm{f}(\mathrm{t} + \mathrm{i}\psi) + \mathrm{f}(\mathrm{t} - \mathrm{i}\psi) = \mathrm{u}(\mathrm{t}, \psi) \ \Rightarrow\ \mathrm{f}(\mathrm{t} + \mathrm{i}\psi) = \mathrm{u} + \mathrm{iv} \tag{19}$$

Figure 6



[2019a] In thick line, a Universe with Big Bang in u = 0, would evolve linearly in a constant way, without Initial Hyperinflation or Acceleration.

In intermittent line, it evolves according to the hyperbolic tangent and the Universe would not present a Big Bang, the coordinate u would collapse on v and would represent a closed but infinite configuration, with apparent asymptotic deceleration.

In a fine line, evolving according to a function of hyperbolic cosine type, it could be adjusted to a hyperinflation as well as to an acceleration, it would represent the asymptotic collapse in the evolution of one of the coordinates over the other (at the Beginning, "strong limit").

Since the expansive reversible sign+ coordinates $(\partial_x = \partial_y = \partial_z = \partial_R) \rightarrow \mathrm{R}^3$, can substitute the spatial coordinates in symmetry and are supposed to do it in a ergodic way with time τ(t, ψ) = R(t,ψ), to preserve the isotropy; the reverse dynamics of the time coordinates with respect to an irreversible coordinate (Greek letters imply 0,123 or 3S+1T or 3-1), will be represented by the four-velocity, u^a,

$$u^a = \delta_\tau^\alpha \qquad \& \qquad u_a = -\delta_\alpha^\tau \tag{20}$$

To deduce (13) in line element evolution -in a Universe without matter- will depend on the Expansion, whose Scale Factor θ(τ):

$$\nabla_\alpha u_\beta = \theta/3(\, g_{\alpha\beta} + u_\alpha u_\beta \,) \Rightarrow \theta(\tau) = \nabla_\alpha u^\alpha = \frac{1}{R^3}\frac{\partial R^3}{\partial \tau} = \frac{3}{R}\frac{\partial R}{\partial \tau} \tag{21}$$

If we introduce an extra temporal coordinate, there will be a time trajectory said, τ(t,ψ) → τ(u,v). The relativistic equations in a generic metric FLRW with more dimensions (lowercase latin letters imply 0,123,4 or 3-2 and uppercase 0,123,45 or 3-3), would be in each 4D projection on the coordinate of the expansion time of the hologram:

$$T_{ab} = \mathrm{p}\,(\, g_{ab} + u_a u_b \,) + \rho(\, u_a u_b \,) \tag{22}$$

$$R_a^b = T_a^b + \frac{\rho - 3p}{2}\;\delta_a^b \;\Rightarrow\; \rho = (\frac{3}{AR}\frac{\partial R}{\partial t})^2 + h$$

$$-p = -\rho + 4h + \frac{2}{\theta R^2}\frac{\partial}{\partial t}(\frac{R}{A}\frac{\partial R}{\partial t})$$

$$R = g^{ab}R_{ab} = \rho - 3p = 6\,(\, h + \frac{1}{AR^2}\frac{\partial}{\partial t}(\frac{R}{A}\frac{\partial R}{\partial t})) \tag{23}$$

Such formalism presents physical interpretation drawbacks (recall from (13) the A(t,ψ)):

1. The motivation and justification of a temporal symmetry that describes an evolution
2. The difficult practical demonstration of the reality of temporary branes
3. The model should be extended to uniformly distributed fluid or gas

A proposal to obviate them, arises naturally by restricting us to Expansion and non-linear symmetries to avoid the Problem of Causality, such as the one represented in a fine line in the Figure 6, which describes the hypothesis of a hyperbolic evolution, which besides including the Horizon Problem, can also assimilate a Closed Universe. Taking for example the observational data of the Expansion, a temporal symmetry that adjusted any curve would be obtained by trial and error, but since we had already done this exercise with the rotational hypothesis, without knowing that freedom of choice, previously we already have a score that we know that it fits with the curve of expansion measured astronomically (we already have one of the solutions, which was the first rotational starting point and from here is uses as a particular example).

A possible approximation without still pretending physical motivation, would be to suppose a Taylor Expansion in the function that relates t and ψ:

$$\frac{\partial R}{\partial t} = \frac{\partial R}{\partial \tau}\frac{\partial \tau}{\partial t} = k_1 + k_2\frac{\partial \tau}{\partial t} + k_3\frac{\partial^2 \tau}{\partial t^2} + \cdots \Longrightarrow cte = \frac{\partial^2 \tau}{\partial t^2} + \cdots \qquad (24)$$

and adjust the coefficients with the observational data, being H_o = ∂R/∂τ constant for a "divine" observer in 3-2.

In an analogous way, the acceleration curve for Dark Energy in 3-1 has been described by astronomical observations, with regressions of the distance module μ, such as:

$$\mu = 44.11\, Z^{0.06} \qquad (25)$$

for the top range on a fully energy dominated Universe

$$\mu = 44 + 2.5 \ln Z \qquad (26)$$

for Z < 2

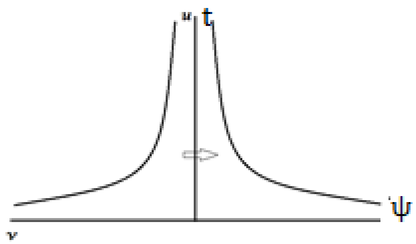
$$\mu = 43 + 5 \ln((Z+1)\ln(Z+1)) \qquad (27)$$

for Z > 2

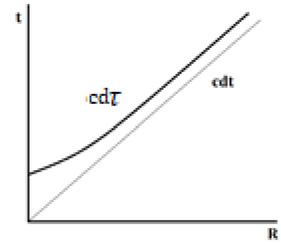
A correlation may contain information or be spurious. It is preferable to start from some hypothesis of physical motivation that provides similar results to a post-discriminative statistical approximation. Rescuing the original rotational hypothesis as an example, with a similar, not identical, shape to the hyperbolic, maintains the Cosmological Principle for each 4D hypersurface: it proposes the *holographic collapse* of one temporal dimension over the other. So, the physical interpretation will be in this work a rotation in the temporal plane respect to space, that leads to the collapse of 3-2 bulk into 3-1 projection. We could use any other non-rotational argument, while approaching similar Evolution of the Universe Expansion by an specific Λ(t), but this one has a physical meaning and we will see is consistent with Distance Ladder data.

The additional free choice between *lapsed time,* t, and *shear time*, ψ, which is acquired by adding a coordinate, requires to be diagonalizable -symmetric- to describe a FLRW metric (in which case the existence of two temporal coordinates would be permanent and we should physically need to explain why we have a specific time trajectory and not another); as if Evolution is proposed by projection of a temporal coordinate from some bulk surface. Thus, they will be compatible with the Time Arrow, Causality, Isotropy, Homogeneity and Variable Constants, and even Conservation Laws, if the temporal shift can be approximated by τ(t,ψ) = cte. In the specific case of the present "projective-temporal" hypothesis, τ(t,ψ → cte) ≃ τ(t):

Figure 7 *Figure 8*



$\Rightarrow$



As observers, we live on the time trajectory τ, but we measure over the time t.

A geometry that relates not linearly times, τ(t,ψ), allows a description of the collapse of a temporal dimension by setting $g_{\psi\psi}$ to zero, which is simplified by converging all projection from the origin to 4D. Inevitably, the collapse of the temporary dimensions of 3-2 to 3-1:

$$\begin{pmatrix} g_{RR} & 0 & 0 \\ 0 & -g_{tt} & g_{t\psi} \\ 0 & g_{\psi t} & -g_{\psi\psi} \end{pmatrix} \rightarrow \begin{pmatrix} g_{RR} & 0 & 0 \\ 0 & -g_{\tau\tau} & 0 \\ 0 & 0 & cte \end{pmatrix} \tag{28}$$

$$\text{If } t \gg \psi, \psi \to 0 \Rightarrow \tau(t,\psi) \to t \Rightarrow \frac{\partial R}{\partial t} = \frac{\partial \psi}{\partial R} \to 0 \Rightarrow R(t,\psi) \simeq cte \tag{29}$$

Being g_{RR} *3x3 diagonal submatrix representing the spatial coordinates.*
g_{tt} *the temporal lapse dimension.*
$g_{\psi\psi}$ *the additional dimension.*
$g_{\tau\tau}$ *the time trajectory resulting from the "second collapse" (τ → t).*
In general, for manifolds distanced by a constant shift, the metric is FLRW; and in the particular case of tending to be null (collapse), they all become in the same way from 3-2 to 3-1, since τ(t,ψ) is the time trajectory that combines the two temporal dimensions.

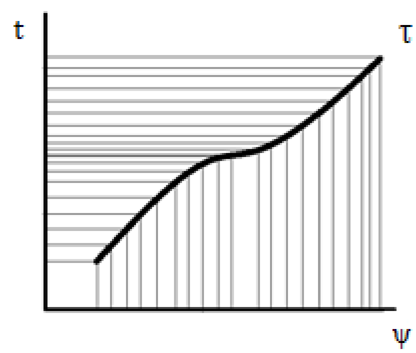
If the observer assumes that the distance cdt = cdτ, very approximate when R is large -related from the Singularity-, ψ variation is negligible with respect to t variation over space, but if not, it will include in the measure an error with respect to the time trajectory in the multitemporal configuration, when estimating the distance at look back times when ψ was not so negligible. Since distances are measured in light-years, implicitly it is assumed the error of confusing a linear trajectory of t with a non-linear trajectory, τ. If we observe an apparent modification of c approaching the Initial Singularity, it would actually be the difference cdt and cdτ, such that cdτ(t,ψ) = ₵(t,ψ) dt, strictly not VSL, since the speed of light would be a constant for every moment of the Expansion, but not for two observers very distant in time who did not share their clocks.

The only way in which c would be constant in reference to any observer, would be if $\partial_R t = \partial_R \psi$ = constant, which would annul in itself the multitemporal hypothesis by coordinate rotation, since the t axis can be translated on the τ axis. This implies that for a second temporal dimension to exist, the time taken by observers residing in the Universe, as a constant reference to measure speeds-one second per second-is τ and not its projection, t.

We insist: it is not that the *Causality Speed*, c, is variable, (it is constant respect the proper time), if they are far away enough they would not share projections and though the scale of their clocks, and vice versa. Necessarily if we take a single time dimension, t, to measure c, we drag a non-proportional relation between t and τ, and if the reference variable is not constant, any velocity that depends on it will also drag the relation. If a second temporal dimension is considered, inevitably the measure of $c = ₵(t, \psi)$ is coordinately variable for two observers living at distant moments of τ, since by coinciding in measuring τ ($\partial_\tau R$ = cte), they cannot agree on measuring t ($\partial_{t1}R \neq \partial_{t2}R$).

Ergo, if the multi-temporality is real, when measuring R with a velocity c, necessarily R evolves non-linearly for an observer who measures parameters of another moment of the life of the Universe. c does not depend on the observer who measures it while the experiment is the same, but it will be apparently variable, if the rules and clocks of an observer in t_1, are used to measure the c of another moment t_2, because the variable with respect to which measures do not evolve the same, seen from τ. That happens necessarily if there is multi-temporality, as every multi-temporal model will be VSL coordinate and every VSL model will have all the constants as variables, -c, G, Ho, h, α-, whenever the observers in different times, with "chauvinist" arrogance, cross their rules, clocks and balances.

Figure 9



The observer who lives in a Universe with two temporal coordinates measures constant the speed of time according to the trajectory τ, but if so, not according to his projections t and ψ, which can lead him to take measurements that will be constant in each projection, but not respect to another with different slope.

Projected time scale will be always shorter than the scale on the function and this will have to do with the Distance because it is measured respect to the wave length of the spectrum of the light, sited on time light years. They only coincide if τ is linear.

The more dimensionality, the more equations and the more variables, so needs more symmetries and constraints!

MULTI-TEMPORAL METRIC

With appropriate symmetries, the holographic projections 3-1 of a bulk 3-2, should be:

1. Consistent with relativistic mechanics.
2. Embedded in a natural range from 6 to 10 dimensions.
3. Consistent with an extrinsic momentum compatible with zero.
4. Causal if expansive, with open causality curves.
5. Anisotropic in time, without the need to be so in space.
6. Isotropic and homogeneous [2019a].
7. Decreasing expansion factor $\partial_\tau\theta(t,\psi) < 0$.
8. Necessarily with non-linear temporal relationship.
9. Necessarily with variable coordinates in time.
10. The variability of a fundamental constant implies the others.
11. Chronological and irreversible (work consumer).
12. Stable and Underdetermined solutions.

Underdetermination offers a degree of freedom for the definition of a relationship between the coordinates that adjust the correlation with the observed evolution, but it is just a correlation (i.e. a power law fulfills all the previous conditions (25), but does not offer a physical meaning: it is not a cause-effect theory). Although the rotational conjecture is not necessary, additional conditions are required to determine the evolution, whose less original physical interpretation is the conservation of a quantity.

With the collapse of the temporal dimensions, the bulk 3-2 is transformed into a 3-1 FLRW manifold model, with a temporal arrow, (not as a persistent holographic construction, but as a convergent evolution to a time-space with conservation constants), which leads to its indirect observability if projections in times enough different are measurable, through the apparent variability of the coordinate speed of the light and, therefore, of any other fundamental constant.

The controversial astrophysical equivalent has been to analyze subtle asymmetries or inhomogeneities in the distribution and polarity of the CMB, of the macrostructures and of the galaxies, or subtle variations in the value of the fundamental constants, but here the proposal is to define conditions in the "weak limit", away from the Big Bang with large R and ψ'(R) negligible, and leaving aside the "strong limit"-without Cosmological Principle-, to add to all the previous conditions, an additional ligature that restricts the freedom of choice in the symmetry temporal: the Conservation of a Temporary Angular Momentum, perhaps inherited from a black hole of another parent Universe, obtaining all of the above as a consequence (or simply, because the regression with the observational data is consistent).

The evolution of the extrinsic curvatures with respect to the extra temporal dimension, would be annulled on any brane in which the symmetry was $-\partial_t R = \partial_\psi R \neq constant -$. Being A(t, ψ), the extra-time line element and θ(t, ψ), the Scale Factor representing a generic evolution, and taking abcde as αβγtψ:

Evolution of the metric to define the curvature, $k_{\alpha\beta}$

$$\frac{\partial g_{\alpha\beta}}{\partial\psi} = -2\mathrm{A}\mathrm{k}_{\alpha\beta} \quad \text{or} \quad k_{\alpha\beta} = -\frac{1}{A}\left(\mathrm{R}\frac{\partial R}{\partial\psi}\lambda_{\alpha\beta} - t\frac{\partial t}{\partial\psi}\delta_{\alpha}^{t}\,\delta_{\beta}^{t}\right)$$

$$k_{\alpha\beta} = -\frac{1}{\mathrm{A}R}\frac{\partial R}{\partial\psi}\left(g_{\alpha\beta} + u_{\alpha}u_{\beta}\right) + \frac{1}{\mathrm{A}^2}\frac{\partial\mathrm{A}}{\partial\psi}\left(u_{\alpha}u_{\beta}\right) \tag{30}$$

1. Curvature evolution, $g_{\alpha\beta}$

$$\frac{\partial K_{\beta}^{\alpha}}{\partial\psi} = \mathrm{A}\left(-\epsilon^{(N)}R_{\beta}^{\alpha} + trk\ k_{\beta}^{\alpha}\right) + \epsilon\, g^{\alpha\lambda}\,\mathrm{A}_{;\lambda\beta} \tag{31}$$

$$Being, trk = g^{\alpha\beta}k_{\alpha\beta} \ \ \&\ \ k_{\beta}^{\alpha} = g^{\alpha\lambda}k_{\lambda\beta}$$

In the classical Cosmological Principle, with homogeneous pressure, p, and density, ρ:

$$\frac{1}{\mathrm{A}R^3}\frac{\partial(\mathrm{A}R^3)}{\partial\psi} = -\nabla_{\alpha}\left(\frac{\partial\mathrm{A}}{\partial\psi}\delta_{\beta}^{t}\right) + \mathrm{A}R_{\beta}^{\alpha} \tag{32}$$

$$Being, R_{\beta}^{\alpha} = \frac{\rho - p}{2}\,\delta_{\beta}^{t} + (\rho + p)\,u_{\alpha}u^{\beta} \qquad \&$$

$$\nabla_{\alpha}\left(\frac{\partial\mathrm{A}}{\partial\psi}\delta_{\beta}^{t}\right) = \nabla_{\alpha}\left(-\frac{1}{\mathrm{A}}\frac{\partial\mathrm{A}}{\partial\psi}u_{\alpha}\right) =$$

$$= \frac{1}{\mathrm{A}}\frac{\partial}{\partial\psi}\left(\frac{1}{\mathrm{A}}\frac{\partial\mathrm{A}}{\partial\psi}\right)u_{\alpha}u_{\beta} - \frac{1}{\mathrm{A}}\frac{\partial\mathrm{A}}{\partial\psi}\frac{\varphi}{3}(g_{\alpha\beta} + u_{\alpha}u_{\beta})$$

Diagonal terms, $g_{tt}\ y\ g_{\psi\psi}$:

$$\frac{1}{\mathrm{A}R^3}\frac{\partial(\mathrm{A}R^3\,trk)}{\partial\psi} = -\,\square\,\mathrm{A} + \mathrm{A}\,R^3 \tag{33}$$

$$\square\,\mathrm{A} = \frac{1}{\mathrm{A}R^3}\frac{\partial(\mathrm{A}R^3\,g^{tt}\mathrm{A}^{\circ})}{\partial t} = \frac{1}{\mathrm{A}R^3}\frac{\partial(R^3\mathrm{A}^{\circ}/\mathrm{A})}{\partial t}$$

$$-\frac{\partial\left(3\mathrm{R}^3\,\mathrm{R}' + \frac{R^3\mathrm{A}'}{\mathrm{A}}\right)}{\partial\psi} = \frac{\partial\left(\frac{R^3\mathrm{A}'}{\mathrm{A}}\right)}{\partial t} + \mathrm{A}^2R^3R^{(n)}$$

No-diagonal terms $g_{\tau t}\ y\ g_{t\tau}$:

$$-\frac{1}{\mathrm{A}R^3}\frac{\partial}{\partial\psi}\left(R^2\frac{\partial R}{\partial\psi}\right) = \frac{1}{\mathrm{A}}\frac{\partial\mathrm{A}}{\partial t}\frac{1}{\mathrm{A}R}\frac{\partial R}{\partial t} + \mathrm{A}\left(2h + \frac{1}{\mathrm{A}R^3}\frac{\partial}{\partial\psi}\left(\frac{R^2}{\mathrm{A}}\frac{\partial R}{\partial t}\right)\right)$$

$$-\frac{\partial}{\partial\psi}\left(R^2\frac{\partial R}{\partial\psi}\right) - \frac{\partial}{\partial t}\left(R^2\frac{\partial R}{\partial t}\right) = \frac{\mathrm{A}^{\circ}}{\mathrm{A}}\frac{R^2}{R^{\circ}} + 2h\,\gamma^2R^3 - \frac{\mathrm{A}^{\circ}}{\mathrm{A}}\frac{R^2}{R^{\circ}}$$

$$\frac{\partial^2R^3}{\partial t^2} + \frac{\partial^2R^3}{\partial\psi^2} = -6h + \mathrm{A}^2R^3 \tag{34}$$

With such non-diagonal terms, each 4D brane evolves consistently with the isotropy according to the equations that condition the dynamics in a holographic 5D bulk-space. The degree of freedom of "*how the additional coordinate of time relates to the classical one*", will be determined by what the scalar (energy) and vector (momentum) ligatures of time-space allow:

$$k_{\alpha\beta}k^{\alpha\beta} - trk^2 = -\epsilon^{(N)}R \tag{35}$$

$$-3\,(\frac{1}{AR}\frac{\partial R}{\partial\psi})^2+\left(\frac{1}{A^2}\frac{\partial A}{\partial\psi}\right)^2-\left(\frac{3}{AR}\frac{\partial R}{\partial\psi}+\frac{1}{A^2}\frac{\partial A}{\partial\psi}\right)^2=-\epsilon^{(N)}\,R$$

$$R+\frac{1}{AR^2}\frac{\partial}{\partial t}\left(\frac{R}{A}\frac{\partial R}{\partial\psi}\right)=-\left(\frac{1}{AR}\frac{\partial R}{\partial\psi}\right)^2-\frac{1}{A^2\,R}\frac{\partial A}{\partial\psi}\frac{\partial R}{\partial\psi}=-\frac{1}{A^2R}\frac{\partial R}{\partial\psi}(\frac{1}{R}\frac{\partial R}{\partial\psi}+\frac{1}{A}\frac{\partial A}{\partial\psi}) \qquad (36)$$

The vector-momentum ligation must fulfill the conditions of symmetry between derivatives with respect to both temporal dimensions:

$$k_{\alpha\beta}=k_{\beta\alpha} \qquad \& \qquad k^{\alpha}_{\beta;\alpha}=k_{,\beta} \qquad (37)$$

At the spatial coordinates:

$$\nabla_\beta(\,k^\alpha_\beta-trk\;\delta^\alpha_\beta\,)=\nabla_\beta[\,\left(\frac{2}{AR}\frac{\partial R}{\partial\psi}+\frac{1}{A^2}\frac{\partial A}{\partial\psi}\right)\,\delta^\alpha_\beta+\frac{1}{A}\left(\frac{1}{A}\frac{\partial A}{\partial\psi}-\frac{1}{R}\frac{\partial A}{\partial\psi}\right)\,u_\alpha\,u^\beta\,]=0 \qquad (38)$$

At the temporal coordinates:

$$u^\tau\frac{\partial}{\partial\tau}\left(\frac{3}{AR}\frac{\partial R}{\partial\psi}\right)-\frac{3\,R'}{AR}\frac{1}{A}\left(\frac{1}{A}\frac{\partial\gamma}{\partial\psi}-\frac{1}{R}\frac{\partial R}{\partial\psi}\right)=0 \qquad (39)$$

The evolution of any of the configurations allowed by a "*Milne type model*" 3-2, conditioned by the scalar and vector constraints:

Scalar-energy constraint:

$$\frac{\partial}{\partial t}\,(\frac{R^2}{AR}\frac{\partial R}{\partial t})\;=\;R^2\,\frac{\partial R}{\partial\psi}\,\frac{\partial}{\partial\psi}(\frac{1}{AR}) \qquad (40)$$

Vector-momentum constraint:

$$\frac{\partial}{\partial t}\left(\frac{R^2}{AR}\frac{\partial R}{\partial\psi}\right)=-\,R^2\frac{\partial R}{\partial t}\frac{\partial}{\partial\psi}\left(\frac{1}{AR}\right)\quad\Rightarrow\quad\frac{\partial}{\partial t}\left(\frac{1}{AR}\frac{\partial u}{\partial t}\right)=\frac{\partial u}{\partial\psi}\frac{\partial}{\partial\psi}\left(\frac{1}{AR}\right)$$

$$\frac{\partial}{\partial\psi}\left(\frac{R^2}{AR}\frac{\partial R}{\partial t}\right)=-\,R^2\frac{\partial R}{\partial\psi}\frac{\partial}{\partial t}\left(\frac{1}{AR}\right)\quad\Rightarrow\quad\frac{\partial}{\partial t}\left(\frac{1}{AR}\frac{\partial u}{\partial\psi}\right)=-\frac{\partial u}{\partial t}\frac{\partial}{\partial\psi}\left(\frac{1}{AR}\right)$$

$$\Rightarrow\frac{\partial}{\partial\psi}\left(\frac{1}{AR}\frac{\partial u}{\partial t}\right)=-\frac{\partial u}{\partial\psi}\frac{\partial}{\partial t}\left(\frac{1}{AR}\right) \qquad (41)$$

The evolution from Cauchy-Riemann initial conditions, collapses ψ:

$$\frac{\partial u}{\partial t}=\frac{\partial v}{\partial\psi}\;\;\&\;\;\frac{\partial u}{\partial\psi}=-\frac{\partial v}{\partial t}\quad\Rightarrow\quad\frac{\partial^2u}{\partial t^2}=\frac{\partial^2v}{\partial\psi\partial t}\;\;\&\;\;\frac{\partial^2u}{\partial\psi\partial t}=-\frac{\partial^2u}{\partial t^2} \qquad (42)$$

$$\left(\frac{1}{AR}\frac{\partial u}{\partial t}\right)^2+\left(\frac{1}{AR}\frac{\partial u}{\partial\psi}\right)^2=0\;\Rightarrow\;(AR)^2=A(\psi)(\frac{\partial^2u}{\partial t^2}+\frac{\partial^2u}{\partial\psi^2}) \qquad (43)$$

At the origin, near to the so coined *Naked Singularity*, radiation dominated, $\rho=3p$:

$$\frac{\partial}{\partial t}\left(\frac{1}{AR}\frac{\partial u}{\partial t}\right)=0\quad\Rightarrow\quad\frac{\partial u}{\partial\psi}\frac{\partial}{\partial\psi}\left(\frac{1}{AR}\right)=0 \qquad (44)$$

$$Taking,\;\frac{\partial u}{\partial\psi}=0\quad\&\quad\frac{\partial u}{\partial t}=AR\quad\&\quad\frac{\partial^2u}{\partial t^2}+\frac{\partial^2u}{\partial\psi^2}=0\Rightarrow\text{ u=t} \qquad (45)$$

That shows Independence on v and though, on cyclic time, ψ; and updating the initial metric, from (45) changing u:

$$R(t) = t^{\frac{2}{3}} \quad \& \quad dS^2 = -\frac{(d\psi^2 + dt^2)}{t^{\frac{2}{3}}} + t^{\frac{2}{3}}\lambda_{\alpha\beta}\, dx^\alpha dx^\beta \tag{46}$$

Changing the classical time coordinate t by τ,

$$d\tau = \frac{dt}{\sqrt{t}} \quad \& \quad \tau = t^{\frac{2}{3}} \quad \Rightarrow$$

$$R(\tau) = t^{\frac{1}{2}} \quad \& \quad dS^2 = -(d\psi^2 + dt^2) + \tau\,\lambda_{\alpha\beta}\, dx^\alpha dx^\beta \tag{47}$$

This confirms the consistency of an important contribution of the shear time only in the "strong limit" at the Beginning, which is reduced with the evolution, moving away from the Singularity, the pressure p → 0 and the Universe happens to be dominated by the density. The model necessarily implies a deceleration in the Scale Factor.

$$\tau(t,\psi) \approx \text{cte} \Rightarrow \frac{\partial^2 u}{\partial t^2} + \frac{\partial^2 u}{\partial \psi^2} = 0 \tag{48}$$

v disappears and make branes independent, as in KK theories

$$\tau(t,\psi) = \frac{1}{2}\left[\mathrm{R}^{(3)}(\mathrm{t}+\mathrm{i}\psi) + \mathrm{R}^{(3)}(\mathrm{t}-\mathrm{i}\psi)\right] \tag{49}$$

If temporal dimensions make up a *holographic bulk*, their projections are isotropic and non-linear, but they can also tend to be isotropic and non-linear if, over time, the projections fall on a configuration of fixed values of the fundamental constants, which makes them tend locally constant in time: *Projective Hypothesis*.

An approximation with symmetry $\partial_t \mathrm{R} = \partial_\psi \mathrm{R}$, cancels the crossed metric terms for any instant, while a projective approximation such as $\partial_t \mathrm{R} = 1/\,\partial_\psi R$, would cancel them in the "weak limit", although they could appear non-neglected next to the Singularity, in both cases results a FLRW metric for each temporary hypersurface, but the second one would be only far from an asymptotic Beginning. A projective interpretation would be described by a line element equivalent to a temporal brane, tending from 3-2 to 3-1 when growing R. In a simple and direct case, (13) again:

$$ds^2 = -\frac{1}{R^2(t,\psi)}\, d\psi^2 - R^2(t,\psi)dt^2 + \lambda_{\alpha\beta}\, dx^\alpha dx^\beta \tag{50}$$

Adding a temporal dimension, the repulsion called Dark Energy, would be described within any hypothesis of relationship between the temporal coordinates and its evolution would be in the same geometric terms as the attraction: the Dark Energy would be embedded in the relativistic equations.

With a symmetry hypothesis , when $\tau(t,\psi) = \tau(t, cte\; t^{-1}) \rightarrow cte\;\tau(t) \Longrightarrow \partial_t R = cte$, by moving away from the *Naked Singularity* and reducing itself into a very small cosmological or astronomical scale, the 3-2 projection tends to 3-1, instead of persisting as a temporary brane. What physics is proposed to describe a persistent temporary brane that holds their projections over t or a bulk projection that tends to 3-1?

In both cases the metric will be isotropic, homogeneous and consistent with the FLRW, although, the relationship between g_{tt} and $g_{\psi\psi}$ need not be linear, close to the Singularity may or may not annul the terms external to the trace: the proper time would not be invariant and Energy would not be conserved, nor isotropy, nor homogeneity; breaking the temporal symmetry that Noether related for conservation laws.

Multi-temporality may embed any dynamical hypothesis of Dark Energy into the GR equations!

DISTANCE LADDER

The way in which a hypothesis in the temporal plane relates the coordinates, ψ = F(t), can be interpreted by analogy in a "temporal dynamics", as inverse to the spatial dynamics: time with respect to space. The objective of these approaches is to choose a hypothesis not only of mathematical possibilities (functions that correlate the astronomical data), but also because physical arguments: that proposes a function that determines the equations to obtain testable results, such that R(t,ψ), be the one observed according to the criteria of the Standard Candles.

An example is to choose among the projective holographic solutions a "temporal rotational evolution" respect to space, in which the temporal dimensions will collapse 3-3 → 3-2 → 3-1, as an approximation in the "weak limit", where the Conservation Laws, the 4D-isotropic metric and constant fundamental parameters can be considered valid approaches. To define a curve of τ projecting on t, here the propose is a conserved quantity, whose solution can be interpreted as a "rotation in the temporal plane that preserves the angular momentum", as a reinterpretation of Lambda, Λ.

The family of geometric solutions for the movement of a particle according to a central force, inversely proportional to the cube -3 coordinates- to its distance to the origin, (Cotes spiral), consistent with the initial Novikov conjecture for a single event, the conservation of specific angular momentum (per unit mass, $h^2 = \Lambda/\Omega$), implies taking a hyperbolic inverse spiral as a model. If the hypothesis were to preserve the angle or the step, other logarithmic models could be taken (it would not be projective) or Archimedes (it would not be stable).

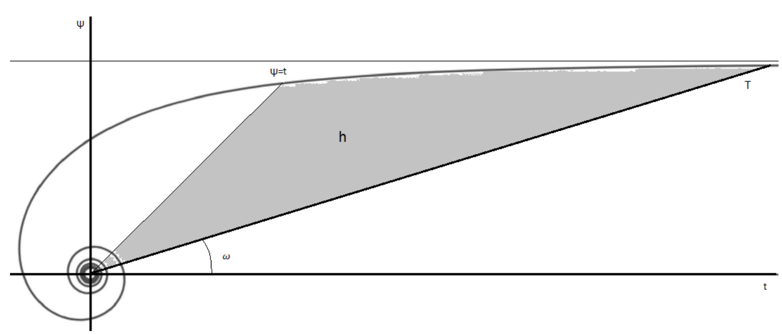
In polar coordinates $$T = B/\omega \tag{51}$$

In cartesian coordinates $$t = T\cos\omega \quad \& \quad \psi = T\sin\omega \tag{52}$$

If this evolution in deep space is identified (the collapse of the second temporal dimension through the variability of the fundamental constants), it only means a transformation of the rules and clocks in the cosmological scale between τ(t,ψ) and its projection over t, which leads to the same result as an Accelerated Expansion in a time-space 3-1, opening perhaps an opportunity to its complete 6D-anisotropic form in the "high energy scale" of the "strong limit".

In this "strong limit", the inverse spiral of the inverse dynamic describes a Big Bang as an asymptotic process until ψ = t:

Figure 10



Space with respect to time or time respect to space is only a matter of signs. Let us suppose "physical" the classic descriptive model of an "angular speed of rotation" ω, in a temporal plane with respect to the spatial axis, said in a toy reduction from 3S to 1S dimension, R=x=y=z, with a preserved **Temporal Momentum $h^2 = \Lambda/\Omega$**:

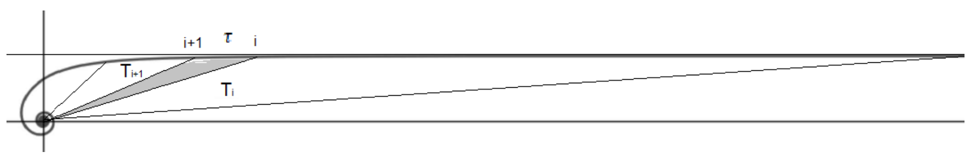
$$\frac{\Lambda}{\Omega} = \int_{\omega_0}^{\omega} \frac{B^2}{2\omega^2} d\omega = \frac{T_0^2 \omega_0}{2} - \frac{T^2 \omega}{2} = \frac{B}{2}(T_0 - T) \quad (53)$$

$$\Rightarrow \omega(t, \psi)\ \alpha \frac{1}{T^2} \quad (54)$$

In polar coordinates units of light-years for the lapsed time T, the shear time, ω, would be in orders of magnitude of 10^{-16} rad/year, compatible with the observed data.

In the "weak limit", the projection of τ over t, would be almost equal to that of T over t, for each section of constant area:

Figure 11



$$\Rightarrow T_{i+1} = T_i - \frac{2\Lambda}{B\Omega} \quad (55)$$

An observer who does not take into account the multi-temporality $\omega_o = 0$, will take as a reference a rotation in the time axis $t = T\cos\omega = T(t)$, which will not fit with τ(t,ψ) in each section that preserves the quantity 2Λ/BΩ, but it will maintain a constant relationship between the three sides of a pseudo-triangle such that:

$$\tau + T = 1 + \tau - \frac{2\Lambda}{B\Omega} > T_o \quad (56)$$

Being *τ, the real time trajectory*
T, the radial time projection proportional to the space coordinates growth
(sin(a) < T < 1, if T_o is set to 1)

This means that necessarily any event at 1-T (usually labeled by a redshift Z), will correspond to such a further distance depending on a. 2Λ/BΩ can have any positive value < T_i, as the conservative section or "piece of cake" i-j depends of size slice, which may be set to some constant to relate a to $h^2 = \Lambda/\Omega$. As it is known that the total temporal momentum from the Big Bang to now, if $T_o = 0$, ω = π/2, then T = 2B/π; from (55),

$$B = \frac{\pi}{4} \pm \sqrt{\left(\frac{\pi}{4}\right)^2 - h^2\pi} \quad \Rightarrow \frac{\Lambda}{\Omega} < \frac{\pi}{16} \quad (57)$$

So, the Universe may be strongly Matter Dominated (> 91%); to preserve 2Λ/BΩ < 1, then B > 0.4; and depending on the h value, the additional time dimension at the Big Bang was around 2/3 of ψ_o (2B/π·sinB). The Big Bang would have been a very long asymptotic process.

As we have set a shape, it is possible to relate the linear time T, whit the trajectory of time in 2D, τ, through the length of the inverse spiral,

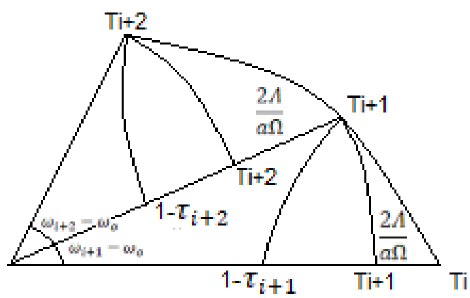
$$\tau(t,\psi) = \int_{\omega_0}^{\omega} \sqrt{\frac{B^2}{\omega^4} + \frac{B^2}{\omega^2}}\, d\omega = B\left(\ln\left(\sqrt{\omega^2+1} + \omega\right) - \frac{\sqrt{\omega^2+1}}{\omega}\right)_B^{\frac{B}{T}} > \frac{2\Lambda}{B\Omega} \qquad (58)$$

For any time in between, time trajectory in the temporal plane will always be shorter than estimated linear time (events that we think happened at 1-T, would be not so old at τ), from (58):

$$\tau = B\left(ln\frac{B+\sqrt{B^2+T^2}}{T(B+\sqrt{B^2+1})}\right) + \sqrt{B^2+1} - \sqrt{B^2+T^2} \qquad (59)$$

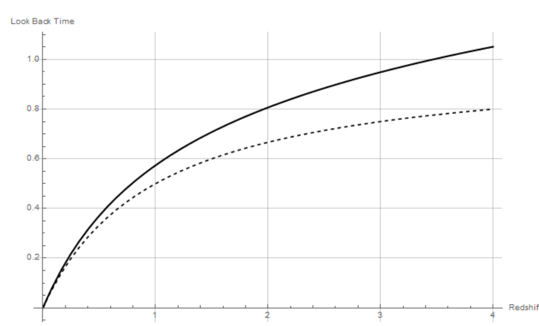
If sections i+j are accumulated, all of them the same area $h^2=\Lambda/\Omega$, the relations between the sides of each pseudo-triangle are kept constant in units of $2\Lambda/B\Omega$, but if the relations between sides of different sections are measured with the crossed rules and clocks of both pieces of the cake, a constant value bias is introduced, which in relation to each radial time T, will be increasing in LBT (the bigger the section is). The observer who assumes a single time dimension will take $T_{i+j}-T_i= 2\Lambda/B\Omega/N$ (setting convenient N, one second per second); but if the observer presupposes a spiral trajectory in a temporal plane, it will take as constant $1-\tau_{i+j}-T_i$, while it is not.

Figure 13



A proportional relation between R and T(t), is non-linearly the same between R and τ(t,ψ). The spatiotemporal 4D metric assumes dR linearly related to dT by a constant c (dR = cdT), but if we measure in another different portion of different T_i with criterion $2\Lambda/B\Omega/N + T_i = T_{i+1}$, dR will also look different because they are separated for a time T_i-T_{i+1}, which is increasing in look back time (LTB): each step increase its length and though the estimated distance is also -like real τ-, smaller in the opposite direction, from the past to now.

Figure 15



An observer considering a 3-2 rotational bulk, will change coordinates at the redshift axis: i.e. for B = 0.4, the Universe size at any T (horizontal) is represented dashed, while the Z at which this size (1/1+Z) correspond to τ (vertical). In this example at 20% of its age (LBT = 0.8), the Universe had 1/3 present size (Z = 2).

The evolution description in LBT of the Universe would be the following set of points:

$$(\tau\,, \mathrm{R_T}) = \left(\sqrt{B^2+1} + B\ \ln(1+Z)\frac{B+\sqrt{B^2+\frac{1}{(1+Z)^2}}}{\left(B+\sqrt{B^2+1}\right)} - \sqrt{B^2+\frac{1}{(1+Z)^2}}\ ,\ \frac{c}{Z+1} \right) \qquad (60)$$

From the *chauvinism* of the observer, assuming that the other observers measure with absolute clock and rule independent on the Expansion, (*Strong Cosmological Principle*), while if there is a second dimension of time, this is true for other observers anywhere in the present, but not true for other observers "anywhen" the past, while the evolution of their scales is not linear, (*Soft Cosmological Principle*):

$$\frac{\partial R_z}{\partial T_z} = 1 - \frac{Z}{Z+1}\Upsilon \ \&\ \frac{\partial R_z(T_z)}{\partial(1-\tau_z)} \neq cte = ¢(t,\psi) \qquad (61)$$

In scale of redshift, but it can be also in scale of c, which as it will be apparently variable, would have to consider a correction of the subjectivity for each section respect the previous one.

Each 4D observer measures time τ and time T as they were the same -and therefore R-, from his situation in the temporal spiral, but an observer in i that intends to measure time in i+1, would misunderstand that time τ_z to $R(T_z)$ is T_z, and would interpret either there is an acceleration or either c is not constant (it is, but the data drives to this appareancy), that in LBT (minus sign), will be:

$$\frac{\partial R_z}{\partial \tau_z} = \frac{\partial R_z}{\partial T_z}\frac{\partial T_z}{\partial \tau_z} \Longrightarrow \frac{\partial R(c)}{\partial R(¢)} = -\frac{\partial ¢\tau_z}{\partial c T_z} = \frac{\sqrt{B^2+T_z^2}}{c\ T_z}¢ \qquad (62)$$

The 4D observer assumes that the Universe expands at a rate $\partial R_z/\partial T_z$ of 1sg/300.000 Km, but from the 5D hypothesis, conserving than relation, she will measure the time respect to τ_z and his assumption means projection. From a variable coordinate scale over T, will seems that c increases in look back time and/or galaxies seems to be further due to some Dark Energy,… but they indeed have to be further, at Z_τ, from the 5D point of view (so, astrophysical data are consistent). The over distance to the luminosity event, is because τ-(T_o-T) and depends on the spiral calibration parameter, $0 < \Upsilon = 2h^2/B < 1$.

$$R(¢) = \frac{1-\frac{d\Upsilon}{dN}}{\sqrt{B^2+(1-\frac{d\Upsilon}{dN})^2}}\ R(c) \qquad (63)$$

Being N, the number of same area sections in which the spiral has been divided, such that as dϒ is constant, what changes is dN, unit of distance for us as observers

A sample of SNeIa&GRB events has to be translated from linear time evolution to the non-linear scale of Z of Figure 15, but instead of a sample we will use the correlation (26) to calibrate B.

The speed of causality will appear to be from our point of view as observers, the result of accumulating the errors in each piece of cake, which is to integrate, the velocities of the history of the previous expression (62), and it is a model that describes our subjectivity as observers when measuring in the look back time, will be a scale factor, $\theta(T) = \tau_z$.

In the unitemporal FLRW metric used to measure Deep Space, the size of the rule changes, but both its divisions and the clock remain constant (one meter and one second were, are and will continue to be one meter and one second, and as the Universe expands, our rules will not expand). Unitemporal and bitemporal FLRW will be comparable while the change projection of the clock $R(Z_T) / R(Z_\tau)$, does not change linearly with respect to distance and while now may be negligible, it will be more difficult to maintain the point of view, the further away over look back time (the bigger is the piece of cake).

From a particular moment in time, we would measure the distance to an object in light-years varying according to a Scale Factor, but it would be the cumulative delay of the clocks -sum or integral- to compensate for the bias of measuring time with our clock and not with that of each observer at each moment. Each megaparsec of the *Distance Ladder* may have a cosmological correction, but also every second would be smaller: the faster, the older.

To compare with astrophysical data from the *Distance Ladder*, we must calibrate the constant that defines the spiral, B. The light distance R_T is established based on the Distance Modulus μ: difference between apparent and absolute luminosity, depending on whether it is taken as reference to τ or to T.

$$\mu = m - M = 25 - 5log_{10}H_o + 5log_{10}c(t,\psi)\,Z + 1086(1 - q_o)Z + \cdots$$

$$R_\tau = 10^{\frac{5+(m-M)}{5}} \tag{64}$$

Luminosity distance is not the Light-Travel Distance, so we may have to change the Z_T-axis to the Z_τ-axis. This is related to the Expansion Speed for each value of the redshift, obtaining the Deceleration Coefficient q_o, by gravitational attraction, (whose value from the presumption of a single time dimension, has been interpreted as acceleration).

$$R_\tau = \left(\frac{c}{H_o q_o^2}\right)\left(q_o Z + (q_o - 1)\left(\sqrt{1 + 2q_o Z} - 1\right)\right) \tag{65}$$

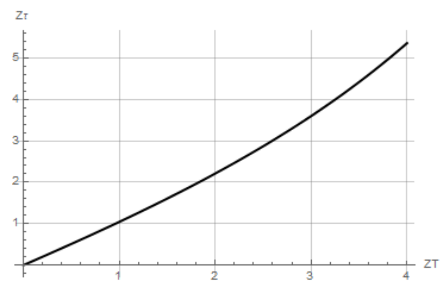
Astrophysical data are given in terms of *Luminosity Distance*, which has a relation with *Travel Light Distance* that depends at less on H_o and ϒ (there are much advanced models including θ, q_o, k, w,…), and for a 4D observer fits quite nice with ΛCDM (H_o = 70, ϒ = 0.7/0.3). Calculator. The set of points translated to Z_T vs μ will give a curve expanded on de horizontal axis, like it was expected to be found if the Deceleration Coefficient were Matter Dominated:

$$\left(\frac{\tau(Z)}{1-\tau(Z)}, 44 + 2.5\, lnZ\right) \tag{66}$$

The fractality of the hyperbolic spiral gives us a reference to calibrate the values of the spiral constant in $B \cong 0.4$, which modifies the sign of q_o and transforms it from "accelerated" to "decelerated", as Multitemporal Metric demands. Thus, from (57), $\Upsilon \cong 0.98$, $\psi_o \cong 0.67\ T_o$ (from the Big Bang to now, the Universe has not even completed a fourth part of a revolution), and matter dominates energy around 11/89.

The overestimation in the calibration of the light distance that we would be measuring by the brightness of the SNeIa or the GRB as *Standard Candles*, would be the consequence of taking Z_T instead of Z_τ.

Figure 14

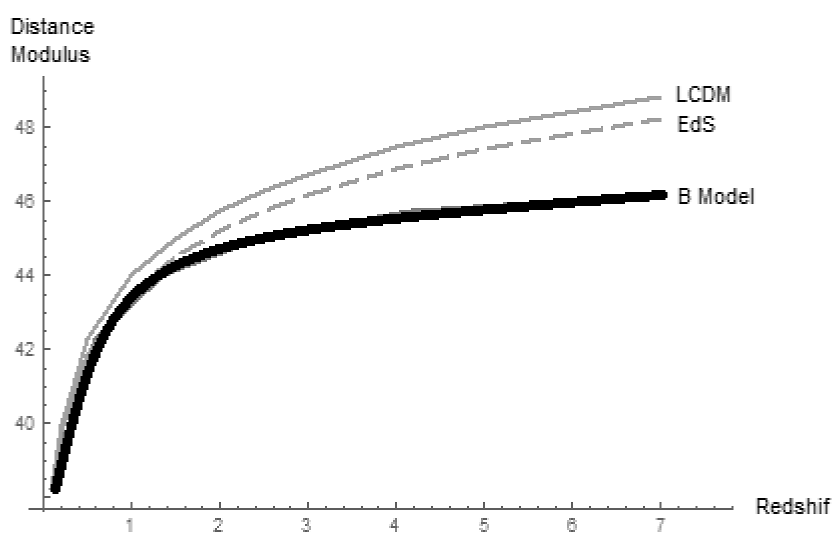


Changing the Redshift Scale in the representation of the SNeIa&GRB distances vs its Distance Modulus, μ, all points will be right misfit, so to represent them accurately, they have to be displaced to the left following this scale transformation.

When Population II Cepheids were discovered, the Universe grew x4, [1944a]. With the 4D FLRW metric, the distance regression matches well with a ΛCDM model (Λ≈0.7, Ω≈0.3) and an open configuration (thin line on the Figure 15); dashed lines represent Λ=1/Ω=0 beyond and Λ=0/Ω=1 bellow). However, when applying the multitemporal correction in the rotational-conservative example for the lowest B = 0.4, the observed data promotes an over deceleration, even more strong than in the EdS bottom model (dashed), that needs a non-Flat Universe with Λ + Ω >1.

Maybe Multitemporal-Rotational hypothesis over acts and Universe is such more strongly dusty that is not Flat. Insisting on both, then either the inverse spiral shape is not the model or either G is not constant and that makes the EdS. Next topic will develop this.

Figure 15

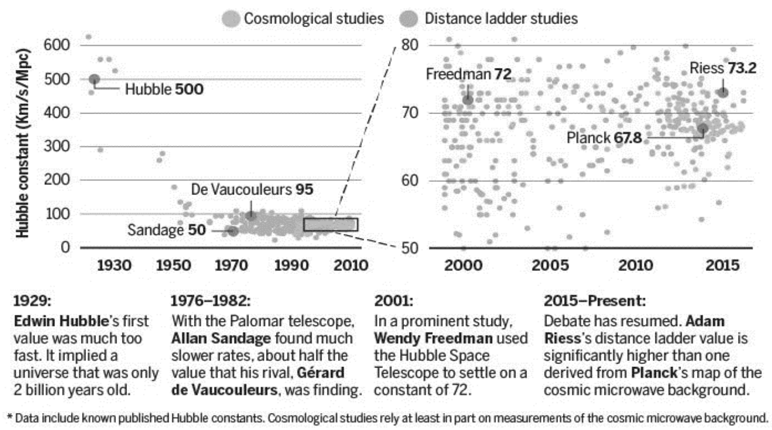


Below Z = 0.2, in the few billions of light years closer to us, but beyond the scope of direct distance estimation methods, the difference between the Light Distances of both assumptions is less than

1%, so that the FLWR metric models would have an application limit, being optimistic about the foreseeable capacity of future astronomical techniques, of Z < 0.2 (scale in which all the galactic meta-structures to the Walls, lives).

The rough calibration may seem to be an effect of the poor representativeness of the sample for higher Z's (Malquimst's Bias) and/or the cosmological adjustment of *Hubble's Law* ($H_o = \theta'/\theta$); but it can also be interpreted from the present alternative, as an indication that the *Hubble Constant* is neither constant. In fact, the observational measurement of H_o in the astronomical scale (71.9 ± 2.7 km/sg/Mpc), diverges 3-sigma from the one made in the CMB (67.8 ± 0.9 km/sg/Mpc), in which Dark Matter is used in the third peak of the harmonic anisotropies, to evaluate it as close as possible to the local value and without it would be much higher, [2010k].

Figure 16



J. You

If so, when in the future more extensive surveys of Deep Space will be available, if the Multi-temporal Metric is considered with the rotational assumption, a greater "extra-redshift" should be observed from the estimated today.

There are more adjustments pending. The calculation of the mass of collapse of a supernova by accretion, is made simulating the gravitational attraction, against the pressure of degeneration in a *cold Fermi gas*. If G changes as we will see next, the mass according to the volume and the absolute magnitude of the luminosity does so with an exponent on that same mass of average 3.3, some effects could compensate others, although beyond the admitted 7% calibration, but the phenomenon it would not be useful to adjust distances as Standard Candle, beyond the same range as Cepheids.

Analyzing the color in the ultraviolet of populations of Supernovas Ia near and far, it is concluded they before were much more abundant than in our local environment -when they should be more rare in younger populations of its Main Sequence- and that their luminosity is not the same [2014k]. So, spectrum has to be included in the distance estimation according to the color. "*The axiom was to go from near to far and that does not seem to be the case*" (Milne,... another Milne).

Other authors question the calibration of the *Distance Ladder*, according to the influence of metallicity on the critical mass. Smolin and Avelino-Camelia propose differences between the speeds of photons with different wavelengths in the CMB, [2009o]. Urban [2011j], describes the friction with virtual particles that should reduce the speed of light. Leuchs and Sánchez-Soto [2013g], propose 100 species in families beyond the tauonic ones, with variable impedances and with different light speeds.

This alternative interpretation is in between Dark Energy proposal and variable c, while it do not assume a variable c, but an apparently variable c. Assuming variable c, Albrecht-Magueijo [1999f] adjusted within the first second of the Beginning Process by two different ways, -Homogeneity and Curvature-, obtaining the same result as later Moffat [2014h], dared to point 1030 times the current speed of c, which translated by both methods at the Beginning of Planck Era, where $cx10^{32}$. Even being theoretical mathematical games, assuming validity up to then, the rotational multi-temporality hypothesis, during the first second of existence of time-space, from our point of view as observers, the speed of light was reduced by at least 10^{29} times. That would be as valid assumption as the Guth over-freezing, which estimates in 10^{26} the expansion of time-space in a period of 10^{-33} seconds, to explain minimum curvatures that eliminate the Flatness Problem as such.

It is possible that what we are measuring is the collapse of the second temporal dimension!

VARIABLE CONSTANTS

There are different methods of weighing matter: X rays, rotational velocity of stars in a galaxy (Rubin, [1970d]), virial velocity of galaxies in a supercluster (Zwicky, [1933a]), weak and strong relativistic gravitational lenses (Zwicky, [1939b]), computerized large scale models of galactic structuring, or analysis harmonic peaks in the pixelization of the CMB (Sakharov's,[1966b]). Although they coincide in results that are always superior to the visible matter, they produce disparate results, sometimes by several orders of magnitude. The scales for the estimation of the DM are not calibrated: the virial calculations are much lower than the estimations by X-rays and gravitational lenses, which in turn, suggest dispersed vs. concentrated distributions, associated to the ordinary vs. independent matter.

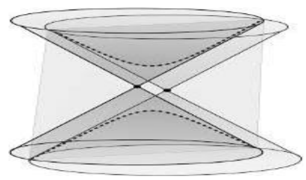
The Dark Matter, DM, includes exotic particles, but also cold and relativistic baryonic components: intergalactic gas, gaseous filaments; neutrinos; planets and planetoids; orbital belts; more than twice as many brown dwarfs as visible stars; black dwarfs; neutron stars, strange stars, black holes; galactic and stellar halos; free hydrogen, water,..., whose existence is observable and extendable by the *Cosmological Principle* where we do not observe them (OGLE project for MACHO samples offer quantities clearly below those expected by the measurements according to the methods cited, [2011n]). Every new instrument's generation, detects unexpected phenomena and masses. As in the case of Dark Energy, an added term "ad oc" is required for the equations of each scale and observed phenomenon to work: Exotic Matter; but in this case there is not a common term as it depends on the method used to measure.

If the *Dark Matter* were the answer, it would not be the same answer for the different questions, because to explain the rotational speed in galaxies, it would need an inverse distribution to the baryon in external shells, when in a cluster it is associated to the baryonic matter. Its presumed presence is in depends on the weighing method used and the object analyzed (measured three orders of magnitude between x3.5 as a minimum measurement by gravitational lens and x3,400 in Segue1, [2008n]). It is not the same DM to justify the masses of galactic holes, the distributions of stellar fragmentation masses or for CMB B-Modes. DM increase on time, but at the same time Dark Matter was generated on the Big Bang. We need two or three types of Dark Energy with spurious dynamics and several more and with exotic changes of Exotic Matter, with migratory dynamics and with transmutations between matter and energy, between baryonic and exotic,... without an identifiable pattern, which must be related and incompatible with each other.

Multi-temporality forces a non-linear relationship between temporal coordinates, this necessarily produces the apparent variability of fundamental constants c and ϒ. If c is from our point of view, variable, the parameter ϒ will be equally apparently variable, while the observers do not calibrate their rules, clocks and balances, with the other's criteria. While c measures the expansion, ϒ estimates the viscosity brake to the time expansion due to the mass.

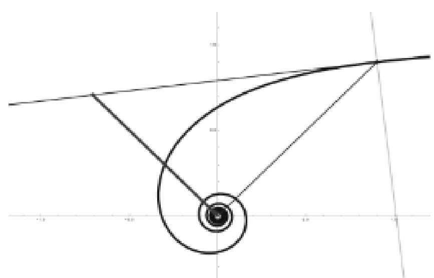
From this narrative point, every massive particle is one-dimensional: a time trajectory in the inverse spiral on the temporal plane. Analogously and orthogonally, a photon would be a one-dimensional particle in a spatial trajectory, not in time: simultaneous in a CTC, where they live. Both of them expands on time, but the braked is opened, which brings Causality. Two points of the manifold of the present, close in space at the local scale, have no mutual access to causality. Two cones more or less parallel according to their mass and/or acceleration, intersect in a hyperboloid deformed according to the orthogonality, which represents the simultaneous reality shared by the photons at the Speed of Causality, c.

Figure 17



In classical interpretation, the rotation implies an acceleration and therefore an anti-gravitational force that expands the Universe, against a "viscosity" ϒ and that is a constant at a cosmological scale that balances the viscosity brake -interpreted as attraction- with the inertial expansion forces due to rotation (we have assumed Λ/Ω also constant), resulting in an inverse spiral. Without Viscosity a rotating Universe would not expand with respect to CTCs and would not be causal.

Figure 18



The tangent to the inverse spiral in the temporal plane is then the Speed of Causality, c, will change the slope for an observer who sees the curve from one more dimension, but it will seem to be constant for the one who measures it from the temporal trajectory itself. The polar subtangent of a reverse spiral is constant and is scale free related to 2Λ/BΩ, so the constant is determined with the scale according to the criterion of a "divine" observer. If ϒ is constant in each conservative section of the spiral, our measurements will be translatable from balance to balance of each "chiral" observer, by known relations according to cosω... unless we reinterpret at the cosmological scale, from the point of view of an external observer, the concepts of gravitational and inertial mass.

Interpreting the centripetal acceleration of the trajectory in the temporal plane as a force, in a Newtonian approximation and taking (54):

$$\frac{\partial^2 \mathrm{T}}{\partial R^2} = 2\omega^2 \mathrm{T} \quad \& \quad \frac{\partial^2 \mathrm{T}}{\partial R^2} = \frac{G\Omega}{\mathrm{T}^2} \tag{67}$$

in the "weak limit" the parameter ϒ apparently changes, depending on how distant they are two observers who do not exchange rules watches and balances. Equivalence between inertial and gravitation, may be another bounded condition to calibrate a with observational data:

$$G = \frac{2B^2(1-\Upsilon)}{\Omega}\frac{1}{T} \Longrightarrow G\ \alpha\ (Z+1) \tag{68}$$

As Dirac's conjectured. So, Viscosity affects to mass but not to energy particles. Inevitably but consciously conditioned by the confirmation narrative bias, the viscosity dilutes according to $T\ (\alpha 1/T^3)$, in parallel to the density of photons, but on respect the same time scale translation to $\tau\ (\alpha 1/\tau^3)$, not according to as a 4D observer implicitly assume. As it was with μ, G would be also affected by the same scale correction on Z (66).

$$\left(\frac{\tau(Z)}{1-\tau(Z)}\ ,\frac{2B^2(1-\Upsilon)}{\Omega}\frac{1}{T}\right) \tag{69}$$

It is in the consideration of both factors in which this hypothesis proposes the explanation of DM, and not in axions and WIMPS, of the Exotic Matter that up to this moment, we do not find anywhere. As the viscosity cosmological constant is 2Λ/BΩ dilutes with expansion, G would be interpreted as its density in time T, while a 5D observer will consider this value from trajectory τ, not T (changing the G value as in Fig.15). Newton did not know the value of G, but of gravitational mass, G·M. G would have the role of modulating the noise of the accelerated movements within the spiral, reality being a non-uniform time trajectory, whose perturbations may converge on t to asymptotic uniformity or diverge to a *Big Crunch*.

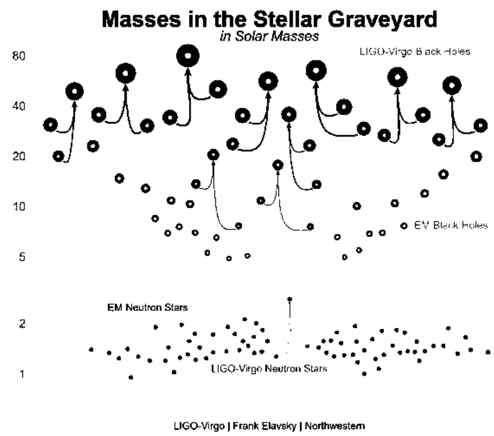
If G in each moment of the time trajectory is α1/T, a cumulative measurement of G would be its sum, which means a logarithmic scale G αln(1/T), over a $Z_\tau(T)$. G will be apparently variable not only for observers when crossing their rules, clocks and balances, but for all observers. Then EdS lower bound for a *Dusty Universe*, that predicts bigger Distance Modulus than this B Model, would not be such, as it do not consider the G variability. If gravitational mass were stronger and faints as time goes on, the low bound for a calibration, would decrease in μ. This also implies a bias that influences the measurement of the gravitational behavior of galaxies, their meta-structures and the description of DM, for high Z's.

Four papers based on the VLT and JWST samples between 0.6 < Z < 2.6 [2017g], point to more "Keplerian" velocity curves in distant galaxies, which leads to interpreting an evolution of DM over time (it could also question if including corrections to supernovae Ia as *Standard Candles*), [1991f]. *Dark matter had less influence in the early universe. Observations of distant galaxies carried out with the VLT suggest that they were dominated by ordinary matter. Genzel, ESO1709*. What processes transform DM into Exotic Matter? If Dark Matter is growing, in LBT may decrease,… how many we may expect to measure at the CMB? It may also be useful for calibration.

However, that also means it does not make sense to apply classical gravitational mechanics to such distances. The constant $8\pi G/c^4$, which relates the second derivative of the metric tensor $G_{\mu\upsilon}$, with the relativistic energy-momentum tensor, $T_{\mu\upsilon}$, would be local and dependent on the volume of the Universe: as the Universe expands, less mass measured with our balances is needed for same effect on the curvature, k.

The predictions of variable G would be observable from relatively close Z's, through the larger masses of the LIGO coalescence events. (At Z = 0.22, -corrected from Z=2-, the masses of the supernovas would be 20% higher than the current ones and therefore those of their black holes).

Figure 19



[LIGO Scientific Collaboration]

The MOND, TeVeS, MOG, CTG, models (Milgrom, Bekenstein, Moffat, Fedosin) develop different strategies to replace Exotic Matter: [1983a], [1984a], [2008a], [2009a], [2009b], [2012p], [2015a]; [2004a], [2009c], [2010a], [2011a]; [2006a], [2006b], [2006c], [2007a], [2007b], [2008b], [2009d], [2009r], [2014n]; [2012a], [2014a], through several conjectures on variable G, [2014b], in the explanation of:

1. Rotational speed of stars in galaxies.
2. Virial speed of galaxies in superclusters.
3. Gravitational lenses.
4. Mass measurements with X Rays.
5. CMB Oscillations.
6. Mesoscopic structure of the Universe.

To which in this example we can add some qualitative observations in Z's > 0.2 (approximate quantitative), which could prop up, modify or discard the model, such as:

1. More "Keplerian" angular speed distribution (from the galactic center to a greater radius) the further away, which has already been verified, [2017g].
2. Events of coalescence of black holes more massive and less frequent the more distant, which without being statistically representative, it seems that the information of the LIGO begins to support, [2018a], [2018b].
3. Low density of black dwarfs or GLMLT stars, with respect to the forecasts of the *Main Sequence*. (Those small stars may live more than the age of the Universe).
4. Greater stellar masses the more distant and metallicity overabundance in the ancient stars.
5. The higher quasars concentration, the further look back time, which has already been verified, [2011k].
6. A subtle rotation in the CMB map, still pending to know “when” Transparency Event was respect to τ.

Gravitational lenses measurements over elliptical galaxies are more than diverse and in some cases they do not find DM at all, [2013i]. Dokkum reports no presence of Dark Matter in NGC 1052-DF2, [2018c]. In the short range, the analysis of Hipparcos data sample of the galaxy disk around us, fails to find any local DM: [1998m], [2000l], [2003q], [2004s], [2006n]. This was backed up in a wider sample by Moni Bidin [2010l], mapping movements of more than 400 stars in a volume four times greater than the one used up to now, located more than 13,000 light-years from us. "*The amount of derived mass fits very well with what we see - stars, dust and gas - in the region that surrounds the Sun. This leaves no room for extra matter that we expected to find. Our calculations show that it should have been clearly seen in our measurements, but simply, it was not there!* ".

If the Universe is Multitemporal, necessarily c and ϒ are scale-free constants, but apparently variables in a rhythm according to the fix scale of the observer, but G is variable for all observers and other fundamental constants can also be apparently and/or really variable and the constants derived from them, such as the *Fine Structure*, the *Chandrasekhar Limit* and many more, too. The same Big Bang event from this hypothesis must be revisited (maybe considered from $t < 0$). An "addendum" is included at the end for the argumentation of such affirmations, since it is additional to the objective of the work.

Multi-temporality is not enough for the description of the Universal Dynamics though is underdetermined, so needs an extra constraint as a hypothesis like temporal conservative rotation, or maybe another. In any case, there are other additional paths to deeply dig, such as:

- the fine calibration of the viscosity constant, ϒ
- the statistical treatment of the possible histories according to variability of the perturbative dynamics of the masses on the uniform reference of $2\Lambda/B\Omega$ (irreversibility in spirals that as noise, diffuse from the main Universal History)
- the Big Bang in the "strong limit" as an asymptotic and slow process and the physics inside a black hole
- the entropy consequence of the first dimensional collapse
- the emergence of mass concentration patterns in rotating condensed systems;...

dependent on quantification based on the conservative hypothesis that is postulated.

Hyperinflation would be an answer to a useless question, because there is no Horizon Problem!

PART III.

THE CONSISTENCY OF THE HYPOTHESIS IS NECESSARY CONDITION, BUT NOT SUFFICIENT. Neither is it for the majority alternative hypothesis, which derives in the Multiverse, Cosmic Inflation, Energy and Exotic Matter; it is not even so for alternative minority hypotheses, STM, MOG, MOND, holographic, dual, fractal,... The interpretation of Dark Energy is still open. Now also to Multi-temporality with some Conservation Law.

CONCLUSIONS

Once established in the first part, the feasibility of the ***Einstein-Kaluza-Gödel-Milne-Dirac-Novikov mixed Hypothesis***, based on a **Rotational Conjecture**, that meets the conditions of causality, stability of the equations, expansion, isotropy, homogeneity, conservation of energy, chronology, locality,... for the scientific literature. Taking instead the single **Multi-temporal Conjecture** with a rotational interpretation only as example and imposing as constraints the so called pathologies, comparing it with the astrophysical observations, in the limit "*Away from the Singularity*", the **viability of this alternative interpretation, is stated in a first approach**.

The demonstration that a Multidimensional Metric, embeds expansive effects in the equations that describe the geometry evolution of time-space, implies that any hypothesis of evolution by a **"Dark Energy", can be enunciated in terms of a relationship between two temporal coordinates** and of its evolution with respect to spatial and agrees with observational data. The degree of freedom in the choice of this relationship is limited by the Metric M [2019a] and by astrophysical observations, nevertheless with wide margins.

If Multi-temporality is real, relation between times is not linear, the Universe has to be in a decelerating expansion, so fundamental constants seem to be variable (while c and ϒ are not, G and other related ones, are); though the Distance Ladder has to be revisited; but more dimensions to include non-linear dynamics on the Universe Expansion, implies more equations and that means to add constraints as the choice of this work, or others: **Angular Temporal Momentum Conservation**.

Until now, the story and the interpretation of the data as Dark Energy, are considered sufficiently supported, according to the hypothesis with its advantages and disadvantages, but, regardless of whether the unlikely reader believes that the previous objectives have been achieved, it can only be theory if the forecasts are fulfilled, not if is academic or not to talk about "*speeds, rotations, momentum or temporal trajectories with respect to space*".

This work does not constitute a demonstration that the Universe started from a black hole with more temporal dimensions, nor that it is in decadent rotation, but states the consistency of formulating the Multitemporal Hypothesis as an alternative to the interpretation of the existence of the Multiverses, Hyperinflation, Dark Energy and Matter. If the Universe conserved non-null angular momentum in a bulk time-space 3-2 (3-3) dimensions, considering it far from singularities-black and white-, the fundamental cosmological constants would appear to be variable parameters, c and ϒ, although in this limit and more in the local environment, they are almost constant.

In other words, if the brightness of the distant supernovae is further than expected, since the units of c are m/sg, the proposed alternative interpretation is that meters should be more, which implies that space expands, because measures are as time does not expand. The alternative interpretation, once the Dark Energy get inside the equations, does not consider the seconds constant in time, but constants in their relation with the meters, so the meters are not more, but from our point of view, seconds are less. **For c to be constant when space expands, the time with respect to which we measure it also expands**. By imposing c to be constant and the Universe to expand, the alternative is to decrease the denominator and that means changing the Z scale.

The multitemporal-rotational interpretation proposes overcorrection observability equivalent to the "Dark Acceleration" in postdiction up to $Z \simeq 1$, but a difference in the prediction up to $Z \simeq 4$ by which will the Universe may seem to be more and more expansive over distance, while it strongly decelerates. It is consistent with the observations interpreted as an Accelerated Expansion because the 4D-linear time ansatz, would attend to the Cosmological Principle and the Principle of Expansive Causality and preserve the validity of General Relativity, except maybe in the vicinity of the Big Bang or a black hole, where neither the isotropy nor the laws of conservation, nor the own GR itself, would be applicable ... and even closer to the Singularity, nor the Multitemporal Metric here deduced, not even the own Causality, because the sign of the dimensions that determines its reversibility, could be reversed, as in fact in some interpretations of the GR equations prescribe for the interior of a black hole, transforming everything into conjectures.

The calibration of B and ϒ, is much beyond the scope of this job and even may be unaffordable because scarcity of data needed in high Z's (not only from the luminosity events, but also from the rotational speeds of galaxies and coalescence events). None of the alternatives -Dark Energy, decreasing speed of light, **B-Model** (as a denomination of this rotational-conservative hypothesis inside the **M-Metric**), or other conservative M-Model would be conclusive, since in both cases other *temporal symmetries* or other *dynamics in vacuum energies*, could be considered.

The interpretation of the distance measurement of events in $Z > 0.2$ and the explanation and some measurements of masses, can be carried out according to the hypotheses about multiverses, hyperinflation, energy and dark matter; even from VSL and VGC theories; but it can also be interpreted that we are seeing a second temporal dimension collapsing, either as proposed here, as a consequence of a temporary rotation of a 3-3 time space, or for another cause of a complex nature than in self-organized criticality into the values of the fundamental constants, promote maybe a "*power law*" or a "*log-normal*". Open doors. None of the options is conclusive, since all of them have margin of adjustment to be adaptable to correlations with the data that can be published in the future in $Z > 2$.

Despite Malmquist's Bias, having to verify in very distant galaxies, probably beyond the technical possibilities, the predictions that should be fulfilled for Z's > 2 can be advanced:

1. Overshift to red with respect to the projection of the regression verified for $Z < 2$.
2. Greater metallicity than expected and relative scarcity of stars with masses < Mo in Population III.
3. "Keplerian" distribution of rotation speeds of stars up to increasing radii.
4. Neutron stars with typical masses of black holes and spontaneous decay of neutron stars in black holes.
5. Enormization of the masses of the GW events; and reduction of the frequency of GW events with distance.
6. The gravity that should be measured in the CMB is 5.75 times the baryonic.
7. A subtle rotation in the CMB map (depending on the elapsed time from $\psi_o = 2B/\pi \cdot \sin B$, may or may not be perceptible)

Acceleration is only a possible interpretation due to deterministic assumptions, not shared by other Physics. Entropy means irreversibility and reality is not deterministic. The SNeIa&GRB astrophysical observations do not means necessarily acceleration, while this interpretation is only from the assumption of linear-time growth. If temporal branes exist, there is room to include any expansion on GR and to consider it as non-deterministic, any trajectory will be longer respect the wave length scale and will interpret the same data as a deceleration because redshift scale changes respect to the Dark Energy interpretation. The rotation is an example but it also happens with any other f(t,ψ). **So, it has been demonstrated here that Dark Energy is a possible but not the only interpretation.**

From positivism, it is irrelevant to question whether or not there are dimensions that we cannot see (but we do feel, if we think on free well, on randomness and on irreversibility), not even if the projective-inverse interpretation is abstract or physical, but if the model that assumes additional temporal dimensions, predicts a falsifiable measurement. Once the hypothesis regarding the scientific documentation, the system equations stability and consistency and the verification of the astrophysical data have been contrasted, both interpretations are alternative accounts consistent with advantages and disadvantages. Whether or not the previous affirmations are furtherly verified, accept or discard them, it will be a small, perhaps insignificant, step forward.

FOLLOW ON

We do not know if the apparent Accelerated Expansion of the Universe is a consequence of a Dark Energy or a decreasing c, as we do not know if there is a Multi-temporality and rotation or other conservative constraint, but if it is real, it constructs a research path in which it could be deepened:

1. Determine the line element and the metric equations that cosmologically defines the temporal-spatial structure 3-3 and 3-2 in a relativistic format.
2. Determine the parameters ϒ, B. The correction of the *Distance Ladder* has been made in this work introducing a correction factor in the redshift, from the observational correlation curve of the SNeIa and GRB, since the calibration of the hyperbolic inverse spiral would require more detail and comparison with data from virial and rotational speed of galaxies.
3. Determine the correction curve of the gravitational mass, that leads to the prediction of greater masses of black hole coalescence events and their projection to the Dark Ages after Transparency, which could explain the mass of central black holes of the spiral galaxies.
4. Use the *hyperbolic hypothesis* to analyze the Big Bang as a slow process -for observers who had rules, clocks and scales in those ages, which from our point of view lasted minutes, seconds or fractions-, with the possible consequences in High Energy Physics. In the same sense, some physics beyond the Event Horizon of a black hole may be developed.
5. Analyze the possible transformation processes of an Extrinsic Temporal Momentum in Matter, Entropy and Intrinsic Angular Momentum, during the *First Collapse*.

All this is beyond the scope of the present work that only seeks to open the possibility of an alternative interpretation to the *Accelerated Expansion* of the Universe and to the *Exotic DM*.

We are maybe in a decelerated expansive Universe that once had more dimensions.

APPENDIX.

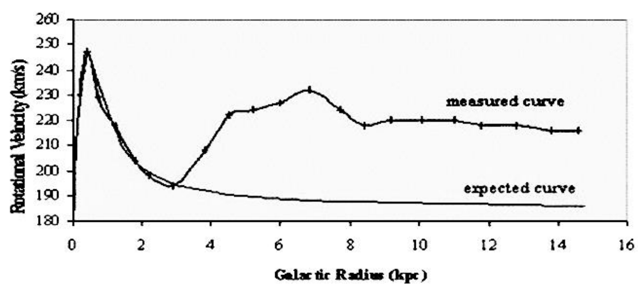
THE DARK PROBLEM

In the *Milky Way* a p^2/r^3 "keplerian" distribution is observed as expected up to 10,000 light-years - in the same magnitude's order of its thickness-, running away from the spiral orbit, the mass distributed to more than 20% of its radio. Then, there is an increase according to the predicted for a spiral orbit to escape, but around 2/3 of the radius stabilizes and remain with approximately constant rotational speeds, when according to the classical model they should be decreasing. It would not be the rotational velocities of the stars of a distant galaxy -v_τ- proportional to 1/√r, but

$$v_\tau \; \alpha \; 1/\sqrt{(r_c/¢)}, \textit{ being } r_c \textit{ the "keplerian" radius} \qquad (70)$$

which makes them dependent on the distance to which the galaxy is -bigger- and the reference radius for the measurement -smaller-.

Figure 19



Astronomy and Astrophysics Encyclopaedia, pp 280-1

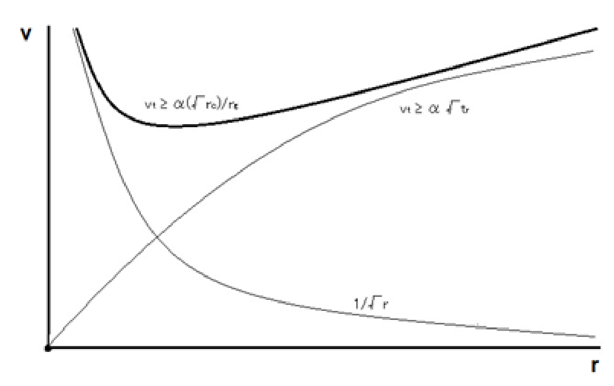
If the Universe has Non-Null Temporal Angular Momentum, the rotational velocities must be conserved when Time-Space is expanded, being the distribution according to *Kepler's Third Law*, as galactic electromagnetic fields are, a brake, but not its full shape. We assume to be gravitational cohesion the centripetal force $F_g = GMm/r^2$, must be balanced with the centrifugal force $F_c = 2mr\acute{\omega}^2 = 2mvT^2/r$, and from this *ansatz,* we deduce the expected rotational velocities curve. What would happen if the constant time metric did not apply as time goes on? That is, if r could not be canceled on both sides of the equation: at different times in history, $r_c \neq r_g$?

Although the mass of the 4/5 parts or more of the radius of the galaxy is in apparent spiral escape orbit, because there is not enough gravity to retain them, at the same time the expansion overcomes that runaway spiral, the distance of the peripheral mass grows, but less than the unit of length that we take as a pattern of the rule, in every moment of the life of the Universe. The smaller the radius is, it will be more evident, because the gravitational attraction is greater.

The distribution of the rotational velocities would be a fossil record of the maximum velocities, corrected by the apparently logarithmic metric of distant stronger G's

$$\frac{r_c}{r_g} = \frac{¢}{c} = \frac{d\tau}{dT} \; \alpha \; Z + 1 \qquad (71)$$

Figure 20



This provides an estimate of the difference in the distribution of velocities in galaxies with respect to a "Keplerian" expected, decreasing at the look back time -with a greater r_c-, which fits quite well with the astronomical observations between 0.6 < Z < 2.6 quoted by Genzel [2017g].

The same could be inferred from the virial velocities of the superclusters, whose gravity centers do not seem to match with the visible matter accumulations. The outline of a galaxy is diffuse, and to adjust r_c and τ on the same axis and system of units, we need a common reference: a galactic radius R_g such that a horizontal line as, $v_T \ \alpha\sqrt((1+Z)/R_g)$, which it may be true as long as the galaxies are not strictly corks floating in a space that expands, gluing the volume due to their gravity, but in themselves they expand as the intergalactic space, although gravity is a brake on them.

The effect of the Expansion in the Earth-Sun is 44 orders of magnitude smaller than the internal gravitational forces of the system. Applied to the solar orbit around the galactic center, the effect is 11 orders of magnitude less than the acceleration due to gravitational effects. Even at gigantic scales of a galactic cluster, the effect of expansion is 7 orders of magnitude smaller than the acceleration itself due to the internal gravitation... today, but has always been so? If G is variable, the effect of modifying the gravitational ligature should be noted in high Z's.

For the intragalactic time-space to behave metrically equal to the intergalactic, gravity cannot be a brake dependent on the distance between masses, which is only possible if G decreases with distance or time, closing the argumentative circle. At 0.61T, the Milky Way's velocity distribution curve was "Keplerian" up to 6 Kpc (twice as much as today). In other words: an outer star of our galaxy, has the same v_T as when it was 13,000 million light-years away in LBT and travels the same number of units of space per unit of time as then, but both have grown proportionally and in fact it is in an escape spiral.

From 5D ansatz, the *Chandrasekhar Limit* decreases with time -it grows with the distance we observe-. Lonely white dwarfs would collapse by overcoming the electronic exclusion pressure just by letting enough time. In high Z's, this adds another correction ratio of distances estimated by the *Standard Candles* method, since the critical mass for a young Universe was greater, (i.e. Z = 0.59, 50% more, Z = 1.35, x2; or Z = 4.17, x3); also the brightness (much more than M = -19.3).

The galaxies should be larger and less dense in relation > $(Z+1)^{1/3}$, because in addition to expanding as the intergalactic time-space itself, in fact they have runaway spirals. On a sample in Z ≈ 4, Ferguson notes in a very old set of galaxies, that they were smaller, irregular and massive, [2004q]. In the same sense, comparing SDSS large galaxies between Z = 0.2 and Z = 1, those with a radius greater than 1.5 Kpc are multiplied by 500, [2004r], [2008m].

With the Osiris Telescope the dispersion velocities -σ- in four elliptical galaxies in Z≈0.9, have been measured with 6 times higher densities, [2011m], than the current average ($(Z+1)^3$ expected), half of the local mean size (larger with Z+1 expected) and only an increase in σ (less than expected Z+1 if the intragalactic space expands similarly to the intergalactic one). The overestimation -and therefore lesser of the rest of measures- in the radius of the superclusters and the diameter of the galaxies, could be due to the fact that the method of determining speeds, when estimated as the angular velocities difference between two points, separated by an angle depending on the radius, would contain a bias when considering this as a multiple of c and not of ¢, (averaged value of c that we would measure from the bias of our time).

The mass calculated by the Virial Theorem depends on the radius of the cluster being constant (2Ec + U≥0) and not being to some degree breaking up (like a raisin in a leavening mass that is expanding), the square of the velocities dispersion and inversely of G, but we have seen that both G and radius are non-linearly dependent on lapsed time, T. Its dependence is nullified and the result would be proportional to $\Delta\sigma^2$, which for Z = 0.9, would mean a overestimated mass of 3.24 times. In any case for the method of virial weighing of galaxies should be observed a further decrease according to $(Z+1)^{1/3}$ of the baryonic/exotic ratio, which leads to 4: 1.

The luminosity depends on approximately the fourth power of the maximum speed (Tully-Fisher) or the dispersion of speeds (Faber-Jackson): "*grosso modo*" of its mass squared. The gas rotation of the superclusters, in which the spectral band of 21cm of hydrogen is more appropriate for long distances; and the stars of the galaxies is blunt: something is missing.

The Sunyáez-Zeldóvich Effect allows to estimate the baryonic matter and the distance of a cluster or supercluster with the dispersion of electrons in reference to the CMB, [1970e]. The pressure gradient of X-rays in clusters -"*free-free"*- measures the amount of hot gas under an ideal assumption of a gravitational equilibrium with the rest of the mass. Although the mass of the intragalactic gas is less to the visible mass, in a cluster it represents 5 times. Comparing micro and macrolenses with X rays, the accumulation in halos [1974d], to explain why we do not find DM in our local environment, is limited to values below those expected.

The integrated Sachs-Wolfe Effect uses anisotropies for computer modeling of large-scale structures. In all cases the consideration of the radius of the halo of dark-baryonic matter, being of an order of magnitude greater than the galactic size, is relevant although not enough. What influence on weighing do magnetospheres have at all levels -galactic, cumulative, ...-, detected by Faraday rotation or with synchrotron radiation in the radio spectrum?

Gravitational lenses -micro and macro, simple deviation and circular lens-, ranges values from 100 to 1 in dwarf galaxies to a mean of 10 to 1 with respect to visible matter, (while if intergalactic H/He is considered, the proportion grows between 80 and 85%), which is much more than with other estimative balances of masses [1992j], [1992k], [2010n]. The angle of deviation $\beta =$

$4GM/c^2\xi$, depends on considering c and G constants, when if what is considered constant is c/G (it is not even in this Hypothesis, but admits it as an approximation), the mass of the deflecting galaxy is linearly proportional to its age, and so with the focus on Z = 0.5, we would be measuring an apparent gravity of only an order of magnitude of 50% more (we should also consider the distances to the deflector focus and object deflected to logarithmic time scale, to give an exact correction).

The current account, from the implicit *constant time with constant constants assumption*, says that by lowering the temperature of the Universe of 10,000 million degrees, the proton-neutron symmetry was broken, in energy range in which a proton can be transformed into a neutron, but do not go back -0.8 and 1.8 MeV-. The primordial baryogenesis proposes relative neutron-proton quantities of 1: 5 (adding beta decay, 1: 7), which deduces one nucleus of helium for every 12 of hydrogen, independently of the initial conditions and is contingent on the spectral observations.

To get to the He_4 traffic jam it has to go through deuterium, between 900 and 300 million degrees. The neutron pairing cycle, through the experiences of deuterium and He_3, averages 13.3 minutes in constant seconds. The neutron in its isotope is much less stable than hydrogen, therefore very sensitive to the initial conditions and the speed of expansion and having had time there would be hardly any traces, but its presence -0.003%, triple that of He_3- indicates that the plasma cooled before everything would be burned, and that Era had to last for years and not minutes. If all the mass were baryonic and the density of the Universe were critical, the trace of deuterium would be more than 6 orders of magnitude lower than that observed in the Ly-α spectrum, which preserves the history of the trajectory of ultraviolet light in its trip through the hydrogen clouds. The argument seems overwhelming, especially because taking minutes instead of hundreds or thousands of years, leads to estimate the baryogenesis between 3.2 and 4.8% of Ω.

The analysis of the granularity of the anisotropies in the CMB, [2015j], show a typical self-similar structure of emergent phenomena by boiling, of scale 1º and frequency around 200, which is quite accurately compatible with a Universe of flat curvature and null critical density (it has been interpreted as a condition so that the energy-matter sum is null). Attending to the Multi-Temporal-Rotational Hypothesis, at the end of the Nucleogenesis and the neutrinos runaway event, a second was equivalent to 3.5 years. If so, it does not burn so much deuterium, the sheared time, ψ, should be that order of magnitude greater than the lapsed time, t. Once the Universe cooled below three billion degrees, the photons no longer have enough energy to dance in electron-positron pairs. With such density, there was no option for some single neutrons to be perverted in protons -as in a neutron star-; or maybe t should supplant the role of ψ, during what we have said "strong limit".

For it to be of the order of magnitude less than the life expectancy of a free neutron and to be consistent with the excess of deuterium, the Universe would have to rotate in that Era, at the most in the order of hundreds of millions of revolutions/second, (maximum therefore in conditions of relativistic speeds, the neutron could have greater life expectancy). Such a Temporal Angular Momentum, calculated to be conserved with the Expansion, would lead to a maximum of one revolution per second with a Universe at 25,000 degrees; or at π/24 rad. in the decoupling (which matches with the moment in which t ceases to be relevant to ψ, sinω < 10% cosω). The minimum temporal radius at which the Universe would stabilize would be on the order of T 10^{-4}

(more or less around 1 million years after Decoupling Era, from our clocks). The apparent gravity would be thus $(Z+1)^{1/4}$ greater than its projection to our time, that is 5,746 times more from the Transparency to today, into the magnitude order of the Exotic Matter proportion calculated with the resonant CDM model.

In a one to two million year old Universe, projection of τ over t started to be approximated and Rotational Era ends. We may be able to identify that rotational rate in the CMB, but as in the Sun we have references like stars or Sunspots, we do not easily find them on the CMB. (Maybe the Big Attractor?).

The configuration of the protogalaxies at the time of their formation should be consistent with the orders of magnitude that mediate between the central holes and the current stars. On that line, history would have left us its tracks: peaks in periods of activity of its central black hole (they should be more abundant the more outward, even tendency to increase v_T with the radius); valleys close to the center; both more pronounced and closer (by decreasing Expansion $\alpha 1/\tau^2$ over time, the gravity will be imposed to knock the curve to the classic $\alpha 1/\sqrt{r}$, escaping the rest), and for the same reason previous compensate and even lower these fossil peaks (it would not happen homogeneously in the radius, but as the movement of a whip given its origin in the center), resulting curves consistent with those observed without the need for non-baryonic DM.

LBT α Z_τ temperature and pressure were Z+1 times the current but there is no contingency beyond the Reionization Era because there are no light sources (ULAS-J1120-064, with Z = 7.085, EGS-z8s-5926, with Z = 7.51, or EGS-zs8-1, with Z = 7.73: 670 million years after the Big Bang, even GN-Z11 with Z = 11.1: 400 million years according to linearized metric with -cdt-, and a star formation rate 20 times higher than the current one). Z_T would be proportional to temperature, while the "when" of those values would be Z_τ.

The 372,000 +/- 14,000 years sized from 4D assumptions for the Transparency, are not an instantaneous event, but the mean of a distribution with deviation of visibility of 115,000 +/- 5,000 years, in which the plasma breaks and changes phase: its turbulent fluid flow dissociates into photonic gas and baryonic gas, which with the Expansion at a much bigger rate than now, drastically happens to interact occasionally, going from turbulence and scarcity of time-space, to a random dynamics, -entropic -... each gas to its business.

Before decoupling, photons flow energy very slowly by radiation - they interact every bit on a very inefficient stochastic walk- and if one thinks of time as any other dimension, the oldest layers of that phase, sited further, were hotter than the more recent, sited nearer. The homogenization of the temperature with the Expansion could become more efficient in its conduction of temperature over time by convection: bubbles in time-space. In its approach, the Horizon Problem implicitly presupposes a conductive communication of temperature and density over time, although perhaps its relationship was turbulent.

If the Universe is modeled without distinguishing between the spatial and temporal coordinates, in the dozens of thousands of years that the decoupling lasted, as if coming from a relativistic degenerate gas polytroph with corresponding gravitational potential n = 5 -radius tending to infinity, which it would be equivalent to a model without matter and pressure-, rapidly decreasing to n = 3 -its hydrostatic pressure would depend on the density, $(\alpha 1/\tau^3)$-; the temperature would take much longer to homogenize only with the movement of the photons and would have to look for other ways. Phase change followed by density reduction at a faster rate than the reduction of the polytroph pressure: with rebalancing waves in the evolution of degenerated plasma to free gas -5/3 <n < 4/3-, on whose instability the system was installed and evolving.

We see the CMB as if it were the surface of a star, and in such a literality we could model it if that hypersurface has radial time (on this dynamics time may be turbulent and occasionally maybe not always increasing). If we do not distinguish the coordinates for the four-momentum, why should we distinguish them to describe the polytroph? From a convective evolution -more efficient in a dense plasma with high specific heat, but without excessive temperature (> 3000º), typical of ionized gases-, one passes with Transparency to conductive homogenization -with photons as carriers of heat (< 3000º) between particles that escape themselves far on from the others. In the limit, of whose detailed CMB snapshot we have, adiabatic movement cells with some hexagonal mesh type pattern would be observed, as anisotropies would be interpreted from this hypothesis (phase change in a boiling surface).

At the end of the Age of Atomization, the pressure of the photon gas suddenly disappears, as it happened eras before when the neutrino gas escaped in what we now call the Age of Nucleogenesis. A sudden phase change in which photons cease to be a brake on gravitational concentration, while the Universe continues to expand. After this, the galactic genesis would be an urgent succession of adiabatic and isothermal states, with shock waves in the changes of prominence of local pressure and opacity, with the dissociation and ionization of hydrogen, the accretion and the centrifugal force, in tracks analogous to those of Hayashi or Heyney for stellar genesis, although their fragmentation happened at a galactic level.

The photons were surrounded by the opacity of baryon densities, facilitating the exchange of heat with the environment-while the critical mass decreased $\alpha(T^3/\rho)$-, gaining pressure with the transition to conditions less and less degenerate, nor relativistic. Like a star, local compression starts fusion processes, which stabilize it in a pseudo-hydrostatic equilibrium that incorporates it into the Main Sequence.

By analogy, the surprising thing would not be the quick structuration of the first galaxies, but the supposed long dark ages of up to 180 million years, according to Bowman, analyzing the 21cm line of the hydrogen spectrum [2018d]. In such analyzes, radio signals have been found at 78 MHz and not at the expected 100 MHz, depending on the temperature estimated at that time: this is only explained if gas was warmer than in the decoupling. This has been used once again as wildcard for DM [2018e], but maybe can be also interpreted as variable *Fine Structure Constant*.

The models of stellar fragmentation do not work beyond our local environment and scale, which limits the maximum stellar masses far below those needed to explain the immense masses that the first generation must necessarily have and the current absence of small primordial stars. If the fragmentation models for stellar genesis are not generalizable to Population III and less to galactic genesis, the "*Wet Silk*" model, supposes the photonic gas as diluent and the baryonic gas as thickener, in an environment where density inhomogeneities are locally fed back.

In a didactic metaphor, it could be compared with a map similar to the high and low pressures of the temperate latitudes of a terrestrial hemisphere, but when expanding, necessarily anticyclonic air masses would be absorbed by the storms, both spinning inertially, leaving ever larger gaps and separating the first pregalactic structures... but we did not observe spatial axi-symmetry, because as we have seen, Universal time rotation was relevant only until 1 to 1.5 million years age. In a Universe in the rotation of plasma charged particles, magnetic fields should print rotational movements within the bubbles that had been configured in convective cells, and maintained a certain cohesion of differential density, offering inertia also differential to those storms and anticyclones.

In those models, photons lose energy density or expand their frequency, but in comparison with the moments before the CMB, the interaction with matter is scarce and the temperature is reduced. A new phase of coupling between density and temperature occurs... in exchange for some energetic adiabatic autism with the environment. After several shakes on the stable line of the Jeans criterion, the system should have been homogenized, like the elliptical galaxies, but in a second phase analogous to that of the nebulae, against the isothermal tendency by the Expansion, something invited the baryons to get out of the local comfort, go on excursions and concentrate by gravity on concentric halos or waves.

In stellar generation nebulae such asymmetry can come from external events such as a supernova, but in an isolated Universe, no one know and DM wildcard has been used for the numerical models to fragment "*deus ex machina*". But it happens that the greater is Z, the smaller is the supposed galactic DM in the halo and in times of galactic genesis the DM necessary for the fragmentation model to be valid, does not meet expectations.

With deviation anisotropies as small as 5 magnitude orders in the density, rotation and convection in time, is at least an alternative explanation to an external event, to differentiate zones of the time-space capable of mass concentrations such that they generate the singularities where around the galaxies grew. As the density of the photons and their cube frequency logarithmically diluted with Z, the gravitational force did so at the same rate (pressure αT^p αM^q). Even with DM and without rotation, we should not exist and the Universe would be a cloud in hydrostatic equilibrium. Something is missing.

Maybe one day we can explore beyond the CMB with some kind of neutrino telescope or gravitational waves mapping and discover some reason that generated such concentrations, but today we do not have more than conjectures. Even in the case of invisible gravitational matter, the adiabatic-isothermal succession is repeated with each local fragmentation and the numerical models must adjust to values not consistent with the current ones to justify the large-scale structure, which in the past was ruled by others parameters to the current stars: gigantic black holes, hypermassive stars,... all at a titanic scale.

Gondolo and others have speculated about the formation in those ages of immense stars of neutralinos [1997n], even higher than our solar system, with low temperature which delayed the formation of stars until they became extinct. Even if we identify the DM and the consequences of a higher gravitational concentration, the models predict very different conditions of large scale structure, IMF distribution and stellar configuration in the Dark Ages.

Matter Concentration in smaller volume, changes the phases of stellar evolution, promoting CNO paths and convective dynamics, both to urgently collapse in singularities and pulsars, which if so, with same values of constants as today, should abound much more. The greater photonic pressure necessary to destabilize, the higher and lower critical limits would be much greater. In stellar environments like this, the virial model prescribes much more abrupt beginnings. As the radiation pressure is inversely proportional to c, the alternative if temporal coordinates of the Universe rotate over the spatial ones, long time ago the size of the Universe was logarithmically smaller and would promote solar masses very-much higher than the maximums of our local environment.

With phenomenological criteria, the models in star hatcheries estimate the fragmentation mass, which determines the size of the local concentrations, as velocities with shape of "shark fin", but if it is homogeneous throughout the space, maybe it is not in time and in the Dark Ages, stars were millions of solar masses heavier. Based on his observations on CR7, Sobral [2015i], pointed out that the first generation of stars -Population III- should expect to have enough space, as to distinguish breeding sites, with foci of collapse much greater than the current ones and that would generate stars dozens of times more massive than the Sun with much shorter live (millions of years of main sequence), leading to intense supernova activity in very early times, with less effective winds, prior to spiraling, large relative production of metals, even heavier than iron, neutron stars, black holes,... especially in the halo. All this followed by massive and selective migrations of baryonic and black DM.

The luminosity of Population III would be in magnitude orders between αT^{13} and αT^{20}, and on the cube of the mass (αM^3, although in extreme cases it can vary from αM to αM^6). If they were exponentially greater than the largest we can observe today (up to 3 orders of magnitude more, with maximum masses proportional to $Z >$ x1.100), they were shorter lived, with higher gravitational density, this would force a relative current overabundance from carbon to beyond iron. Greater and more frequent super and hypernovas in quantity also proportional to their Z's: hundreds of times.

The stellar fragmentation must have been much greater than the current models presume, which prescribe a quiet and relatively long awakening. Devlin [2009n], reported star formation rates hundreds of times greater than the local one in $1 < Z < 4$. Everything is consistent with the abundant presence of metal traces in very old Population II stars, which would cover several successive generations, each time longer lived, with up to 3 orders of magnitude of difference in metallicity with respect to the Sun. In our galaxy they constitute almost 40 %, more abundant the more abroad and the more rebirths [1993h], [2012o].

With such masses -millions or more times bigger than our local environment-, the formation of black holes should have been greater, except if we also consider that on the contrary, the critical mass must have been much greater than the current one: if ¢/c $\alpha 1/T$, but M_c $\alpha 1/T^3$. The detection of gravitational waves of coalescence events between large stellar masses, should not necessarily mean black holes, since hypernovas would be heavier without collapsing in black holes, than the current ones and nevertheless could remain inside physics, emitting energy and been seen. (The way to see it, is the different spectral signature in the X Band, from the light rays that fall on a solid object or inside through an Event Horizon).

We know the process of formation of stellar black holes, but we do not know how the galactic centers collapsed, between 5 and 10 orders of magnitude greater than the largest possible star masses (100, 120, 150 M_o, although Crowther determined for R136a1 a mass 265 times the Sun [2010m], and given its position in the *Main Sequence*, its mass at birth was 320 times). If they come from the same process of stellar collapse, models of *Dynamic Capture* and *Dynamic Friction*, with high accretion activities have been proposed, which is qualitatively supported by the high energy of the quasars and the relative current inactivity that can observe.

The coalescence is so coined as *Final Parsec Problem* [2003r], and models point there is no time for such migration and such collision models between galaxies. At least before the 1,000 million years, the galaxies were already huge (Caputi [2011l], with a census of 574 galaxies), and the early spiraling is striking, having dated to Q2343-BX442 in Z = 2,18, symptom of the very early "enormization" of the galactic centers. Black galactic centers have been identified even at about 12.7 billion light years (Q0906+6930), which implies that if it had happened, such a migration was very early and fast... without anyone knowing or guessing the reason for such a trip. It seems increasingly clear that they could not come from stars only tens of times greater than the Sun that in a few thousand years ate other thousands, tens or hundreds of thousands of times its mass. Because this Problem, is been conjectured previous micro-singularities, which should to be much more massive than any star and would force to redesign the acoustic model of the CMB -or perhaps reconsider the composition of the baryonic DM-.

Like black holes, the biggest stars are getting smaller... perhaps the first ones were earlier than the first, with masses of tens or even hundreds of thousands of suns. Where are the black mega-holes of intermediate masses between the galactic and the stellar? Why did not the galaxies break into sub-galaxies over these new centers? From much larger primary stellar masses and with the help of very high ratios of star formation and much more activity in the accretion that this model foresees, the mystery of the galactic centers would be much better explained.

It is not clear if black holes can be formed from blue supergiants without a supernova process, which would allow masses up to a few hundred M_o, (it has been speculated as the cause of some of the Long-GRB), an order of magnitude more to the processes that are well understood, but even so, they are far from the hundreds to the millions. According to estimations of masses between the central masses and the halo in primordial galaxies, [2009q], when the spiral galaxies were formed, they did so around a preexisting black hole, which already oscillates in masses between millions and tens of thousands of millions of solar masses (this includes the critical mass plus the mass-energy absorbed in its active phases, less the radiation dissipation of Hawking).

In the first light, Population III stars of tens or hundreds of solar masses could be much more abundant and would have been recycled quickly, but in the opposite direction of the masses of the observed model of *Main Sequence*, why would there be a lower limit of accretion and fragmentation of hydrogen clouds other than the current one? In each generation, dwarfs less than ¾ Mo, should accumulate by having a sequence greater than the age of the Universe and among them some significant part should be primary. They are not.

We have not found stars from G5 with a clean spectrum, although they should have low metallicity, which seems to imply that there were no small stars in the first generations, but in Population II. The local average is about ½ Mo. The IMF models (Initial Mass Function), of stellar masses distribution, when transported to the early Universe are inconsistent: they predict a great abundance of stars of smaller masses than the solar one for the current conditions, but they must resort to suppose other to explain why we do not observe an immense abundance of orange primary stars < 0.8 M_o (with life expectancy higher than that of the Universe itself to date), red

<0.35 M_o (they cannot fuse helium), even brown <0.072 M_o (limit of lithium), nor hydrogen superplanes <0.013 M_o (deuterium) -size of a hundred Jovians-.

In orders of magnitude, a galaxy is a million times denser than the average of the Universe; a cluster about ten thousand times, a supercluster about ten times... decreases according to the inverse of the cube, which some interpret as another indication that the structure resembles river basins, from galaxies to filaments, and not the other way around. Even being a wide range, there is no distribution but from *Silk Masses* from 10^7 to 10^{13} M_o, range perhaps by chance analogous to the difference between the major stars with respect to the minor stars; analogous to galactic black holes with respect to stellar ones; or analogous to the smaller stars of Population III with respect to the current smaller brown dwarfs. In its genesis something happened so that the clusters, galaxies and stars, have without exception intrinsic angular momentum. There is no random dispersion from small groups of stars, galaxies and stars.

In the 70s, against the Russian *top-to-down* approaches with adiabatic disturbance from cumulative mass proto-structures -10^{14} M_o-, with numerical models predicted larger universes fluctuations than those observed in the CMB, with much more grouped matter in intermediate structures; the Americans proposed to separate the baryonic fluctuations from the radiative ones in the Plasma Era, with *down-to-top* models with isothermal perturbation from minigalaxies -10^5 M_o-, which were either not satisfactory. Since then, n-body models have been combined with inflation theories, superstrings and non-baryonic DM, leading to increasingly opportunistic parametrizations, and they still do not explain the acquired intrinsic angular momentum and magnetospheres, [2014l]. The data of what is interpreted as Dark Energy, supports among them those of the CDM family -Cold Dark Matter-, which includes non-relativistic exotic particles.

The estimations are several orders of magnitude away, although given the scarcity of observations (GW's), it seems that the most optimistic are imposed, with a collision between two black holes every 10 billion years per galaxy. The ones confirmed so far are between 500 and 1000 Mpc, which implies Z's < 0.2, too close for the change in c to be measurable, but enough for the masses of the events in coalescence to be appreciably higher and coherent with the predictions for a local environment of a rotating Universe.

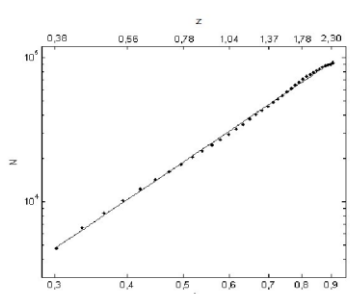
The gravitational masses were greater than the cube, but so was the linear velocity of escape from a black hole, so that their critical masses should be $\alpha(Z+1)^2$. The intentions aim to multiply by 10 the scope of interferometers by the mid-2020's, which will allow Z's to be greater than 1, when the masses of the coalescence events will be up to 8 times greater, implying that perhaps what we think are unification of black holes, were neutron stars in those ages. We do not know how much *Malmquist Bias* affects the sensitivity window to the frequencies of the LIGO, improved at low frequencies -for collisions between very massive objects-, rather than at highs, and is optimal for the typical binary masses at the order of 60 M_o that have been calculated as more typical in the coalescence of black holes,... but at high Z's such masses should not be common as black holes, but as stars.

If its genesis was stellar, it would imply that they come from pairs of hypernovas of stars of masses greater than the very much largest star hitherto found (they could also be second or third generation black holes, which would still make the interpretation more obtuse): the estimates that should have been confirmed would have been worse than the most pessimistic, because the models do not bet on such masses. Given the enormous lapse of time necessary for two stellar masses with an average separation to orbit, losing moment until converging (in the order of 10,000 million years), it is not plausible to consider several generations but as an exception. We would expect masses of black holes smaller than 18 Mₒ, [2003o], and among the less than a dozen of perceived events, almost all correspond to coalescence of one of the two masses in a kilonova event, when not both, greater than that maximum estimate. There are not enough events to do statistics, but at the moment everything indicates that there are more collisions of objects exceptionally more massive than expected according to the model of the current Universe.

The numbers do not come out without DM, not even with branes and shadow galaxies of the multiverse (Randall-Sundrum), but they neither do not come out with Dark Matter, and if that were not enough, it is compulsory to add the primordial black micro-holes, if description want to continue the genesis by accretion on preexisting singularities. Taking as reference the galactic central black mass, the gravitational density has decreased α1/T (if cumulative as ln(1/Z+1)), from the formation process of the galaxies "grosso modo" in the order of between 3 10^7 and 10^{13} Mₒ to 3Mₒ. Considering the gravity α1/T^3, the critical mass of black holes as the galactic centers, would have occurred in Z's long before Transparency. The magnitude orders following the Rotational-Multi-Temporal Hypothesis matches. Chance? Confirmation Bias? Little accurate? Too many maybe's? Maybe, just another circumstantial hint from the Non-Null Angular Moment, or just a warning that it is risky to pose the simplification of neglecting the *sheared time* before Transparency. If LIGO detects coalescence events of hundreds or thousands of solar masses, there will not be alternative to consider this Hypothesis.

Although much more energetic events may be measured in the future up to the GZK limit. Temperatures up to 10^{10}ºK, (equivalent to Z > 3^{109}) have been achieved in hadron colliders, far from the 10^{32}ºK taken as initials, according to our constant time measurement pattern. Eras of protons, neutrons, electrons, neutrinos, photons and many other particles of a zoo, more organized than now in what we call Plasma, with units of time billions of times smaller than current ones and with c and G equally much bigger. Between the runaway of neutrinos and the runaway of photons, we have an estimate of the relationship between temporal coordinates in those eras of strange metrics, in which both times were relevant and maybe turbulent. Without considering angular momentum, density, symmetries, entropy, colliding particles at high speeds, we may be experimentally analyzing Plasma from a partial and incomplete perspective.

Figure 21



[2011k]

The hurry of the Universe in forming the quasars, blazars, Seyfert galaxies and radiogalaxies, which are surely perspectives of the same phenomenon seen with different angles: gas emissions orbiting enormous galactic black holes; while they are not close (from their maximum in Z = 2.5/3 the density of quasars declines drastically), their activity increases in look back time; red extracurrents exponential with distance; the antiquity of long GRB; the Great Attractor; galaxies too distant and stars too old; spiral galaxies structured around black holes much larger than those that can now be born from stars; the absence of medium size holes and the apparent scarcity of these singularities that should be much more abundant; the greater density and smaller size of the primitive galaxies; the ratios 3 orders of magnitude greater in the formation of stars in Population III (starbursts); the GZK limit and how far-old- they are; laterality and anisotropies in axes or orientation of galaxies; inconsistent models of fragmentation that change over time; distributions of DM in galaxies that change over time; metallicity;... they begin to point out that in some way it is necessary to review the models on a large scale in a more fundamental way to the patch on patch in which we are.

[2017h]. Numbers do not come out: black holes should have swallowed millions of times their own initial mass! There are so many necessary assumptions -decay from baryonic to non-baryonic, masses of fragmentation much older, black holes immense but smaller than the galactic centers, migrations,...-, none of all observed. To overcome the problem, these models prescribe migrations to the galactic center, singularities expelled swarming in the intergalactic spaces and a density of black holes far from the center much greater than the observed, distributed in concentric haloes, which nevertheless should remain gravitationally bound with their mother galaxy.

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