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ABSENCE OF UNIVERSE EXPANSION, DARK MATTER AND DARK ENERGY IN THE NEW ISOCOSMOLOGY WITH UNIVERSAL ISOSYMMETRY

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Abstract

We show that the expansion of the universe, the increase of the expansion with the distance, dark matter, dark energies and other cosmological views are a consequence of the assumed exact validity of special relativity for all possible conditions existing in the universe, expectedly, until the end of time, despite conditions dramatically different than those of the original conception and verification, basically restricted to point-masses in vacuum (empty space). In the hope of initiating the return to a due scientific process in astronomy, we recall the experimental evidence showing the alteration, called mutation, of the Minkowskian spacetime caused by physical media and the rather vast studies conducted for their quantitative and time-invariant treatment known under the names of (axiom-preserving) isospacetime, isosymmetries, isorelativity and isocosmology. We then show that isorelativity permits a quantitative and invariant treatment of intergalactic space as a physical medium with a well defined energy density causing a decrease of the speed of light due to loss of energy to the medium, with consequential cosmological redshift without relative motion (isoredshift) that eliminates the expansion of the universe, the increase of the expansion with the distance and dark matter, while representing the cosmic microwave radiation via the energy lost by light to the intergalactic medium and returned in the sole possible way, via radiations. We then recall the vast evidence that the maximal

causal speed in the hyperdense interior of stars, quasars and black holes is much bigger than that of light in vacuum, thus yielding an energy equivalence much bigger than that for point masses in empty space that eliminates any need for dark energy. We indicate the differences of isocosmology with Zwicky's "Tired Light" cosmology and show that the covering isorelativity resolves known problematic aspects. We finally propose experiments feasible on Earth with current technologies permitting the resolution of the vexing problem as to whether the universe is expanding or not, in order to terminate the ongoing selection of cosmological models via the mere use of academic consensus, and the overdue return of astronomy to the serious experimental foundations initiated by Galileo Galilei.

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1. Imbalances in astrophysics and cosmology

As it is well known, special relativity (see the historical contributions [1-6]) has a majestic axiomatic structure and an impressive experimental verification, as a result of which the relativity was assumed in the 20th century as being valid for all possible conditions existing in the universe and, expectedly, until the end of time. In fact, all astrophysical and cosmological studies conducted in the 20th century have been based on the assumption of the strict verification of special relativity with particular reference to the universal constancy of the speed of light throughout the universe. Consequently, all 20th century cosmological models and conjectures, such as the expansion of the universe, its increase with the distance, dark matter, dark energy, and other conjectures [9-18], are a direct consequence of special relativity laws.

The adaptation of the universe to a preferred theory without a serious scrutiny of its limits of applicability, has caused scientific imbalances of truly historical proportions, such as:

1) *Return to the Middle Age assumption of Earth at the center of the universe.* According to Hubble's law [18], the redshift is proportional to the distance from Earth in any space directions, thus implying that the universe is expanding isotropically. Even though this notion is applicable to all points in the universe, it tends to suggest an (unspoken) return to the Middle Age belief that Earth is at the center of the universe. Besides the uneasiness caused by such an occurrence, the hypothesis of the expansion of the universe has now passed all limits of plausibility, thus requiring a reinspection, e.g., because far away diametrally opposite galaxies are at a relative distance more than double that permitted by the assumed age of the universe, or the speed of the latest detected far away galaxies is approaching or even surpassing that of light, and similar occurrences on whose comparison cosmological models without the expansion of the universe are much more plausible.

2) *Self-accelerating expansion of the universe against gravitational attraction.* Hubble's law is assumed [9,18] as one of the biggest evidence supporting the Big Bang conjecture [10]. However, the Big Bang is fundamentally unable to explain the acceleration of the expansion with the distance from Earth without returning, again, to some Middle Age type of unknown mechanism. Additionally, the Big Bang violates Einstein's grav-

itation because general relativity predicts that galaxies *attract* each other, thus implying a *decrease* (rather than an increase) of the expansion of the universe over very large periods of time.

3) *Expansion of the ether.* Since there is no plausible theory compatible with special relativity that can explain the expansion of the universe and the increase of the expansion with the distance, we have recently seen extremes of theologies such as the conjecture that the ether itself, as a universal substratum, is expanding [17] and, in addition, the expansion increases isotropically with the distance from Earth, with the insidious possibility of placing Earth at the center of the universe.

4) *Complacent dark matter acting in front of selected stars.* It is evident that, if uniformly distributed within a galaxy, dark matter cannot possibly have any impact on the dynamics of stars. Therefore, the sole possibility is that dark matter is complacently placed in front of stars, not of all stars, but only in front of selected stars having an anomalous dynamical evolution with respect to gravitational laws.

5) *Complacent dark energy filling up the universe to verify Einstein's relativities.* Cosmology has seen truly incredible conjectures, the last one being that a mysterious and invisible energy constitutes at least 74 % of the universe, fully admitted for study because verifying Einstein's theories, with the evident, thus studious exclusion of the most plausible occurrence, that Einstein's theories are inapplicable fo the ever increasing complexities of the universe that were basically unknown during Einstein's time.

It is evident that the imposition of special relativity as valid throughout the universe has caused the crossing by astrophysics and cosmology of all boundaries of serious science in favor of pure theologies proffered on grounds of collegial support of Einsteinian theories, rather than serious physical scrutiny independent from any preferred theory.

In entering the third millennium, it is time to reestablish a credible scientific process in astrophysics and cosmology that can be solely implemented via the identification of the conditions of exact validity of special relativity, jointly with their *limitations.*

In this paper, we assume special relativity to be *exactly* valid for the conditions of its original conception and experimental verification so limpidly identified by Albert Einstein in his writing, that is, *for point masses and electromagnetic waves propagating in vacuum (empty space).* Jointly, we

assume the rather vast evidence [3] according to which special relativity is *inapplicable* (rather than "violated") for broader conditions because not conceived and/or verified for them, among which we mention [30a]:

a) The classical treatment of neutral antimatter stars and galaxies, that is impossible for special (and general) relativity, trivially, because the sole distinction between matter and antimatter is the sign of the charge;

b) Irreversible processes, such as all energy releasing processes, for which special relativity predicts, from the strict reversibility of its axioms, the existence of their time reversal image in violation of causality laws;

c) Contact nonlocal interactions among extended particles that are beyond any dream of representation with special relativity for various technical reasons beginning with the basic local-differential topology; and other conditions (see Refs. [30] for the resolutions of these limitations).

In this paper, we show that the inapplicability of special relativity for the dynamics within physical media offers realistic possibilities of eliminating the expansion of the universe, the increase of the expansion with the distance, and the existence of dark matter and energy.

In this paper, we study the simpler case of cosmological redshift without any Doppler redshift, that is, without any expansion of the universe. The more complex case of anomalous Doppler redshift, that is, conventional redshift due to relative motion plus anomalous redshift caused by physical media, is contemplated for study in a subsequent paper.

2. Lack of universality of the light speed.

The scientific obscurantism affecting astrophysics and cosmology is a consequence of the widespread belief of the *universal constancy of the speed of light* that is ventured without the crucial specification *in vacuum* (conceived as empty space). Such a belief has been propagated for the intent of maintaining the validity of special relativity throughout the universe while the constancy of the speed of light has been solely verified in vacuum.

In reality, physical media are generally opaque to light. Therefore, the very notion of light, let alone its speed, have no known physical values for opaque media, such as certain solids, as well as the interior of gravitational singularities. As an example, according to recent studies (see Section 7), the interior of black holes lacks the conventional notions of space and time

needed for the very definition of speed.

For the particular class of transparent physical media, *the speed of light is a local variable whose value depends on the characteristics of the medium in which it propagates,* according to the historical law

$$C_{pm} \;=\; \frac{c}{n(r, f, d, \tau, ...)}, \tag{1}$$

where: C_{pm} denotes the speed of light within the considered physical medium (pm); c is the speed of light in vacuum; and n is the familiar index of refraction with an explicit dependence on distance r traversed by light, its frequency f, the density d of the medium (defined, e.g., as energy per cubic centimeter), the temperature τ, and other possible quantities depending on the problem at hand.

Law (1) was well established in physics since Newton's time, but abandoned since Einstein's time. In fact, organized interests on Einsteinian doctrines have produced all sport of "arguments" aiming at bypassing law (1) in favor of the "universal constancy of the speed of light" even within physical media. It is sufficient in this respect to inspect the various "arguments" of Refs. [9-17] and literature quoted therein, with particular reference to the cases of speeds smaller [14] and bigger [15] than that in vacuum. Particular attention should be given to the omission in Refs. [*loc. cit.*] of opposing evidence.

A widespread "argument" is that the variation of the speed of light within transparent media, such as water, is only "apparent" (sic) because, when light is reduced to photons scattering among the water molecule, the speed of light in vacuum c is recovered in full, thus maintaining the validity of special relativity also within physical media.

It should be indicated for the ethically sound scholar that the above "argument" has been long proved (see Refs. [28b] of 1991 and earlier papers quoted therein) to have no serious scientific grounds. Scattering of light causes dispersion with consequential the blurrying of the light source that can be seen by the naked eye not to exist in water, thus rendering the above "argument" a machination to salvage special relativity under conditions for which it was not intended for. Additionally, the "argument" is disqualified by the following evidence (ignored in Refs. [9-17] and papers quoted therein):

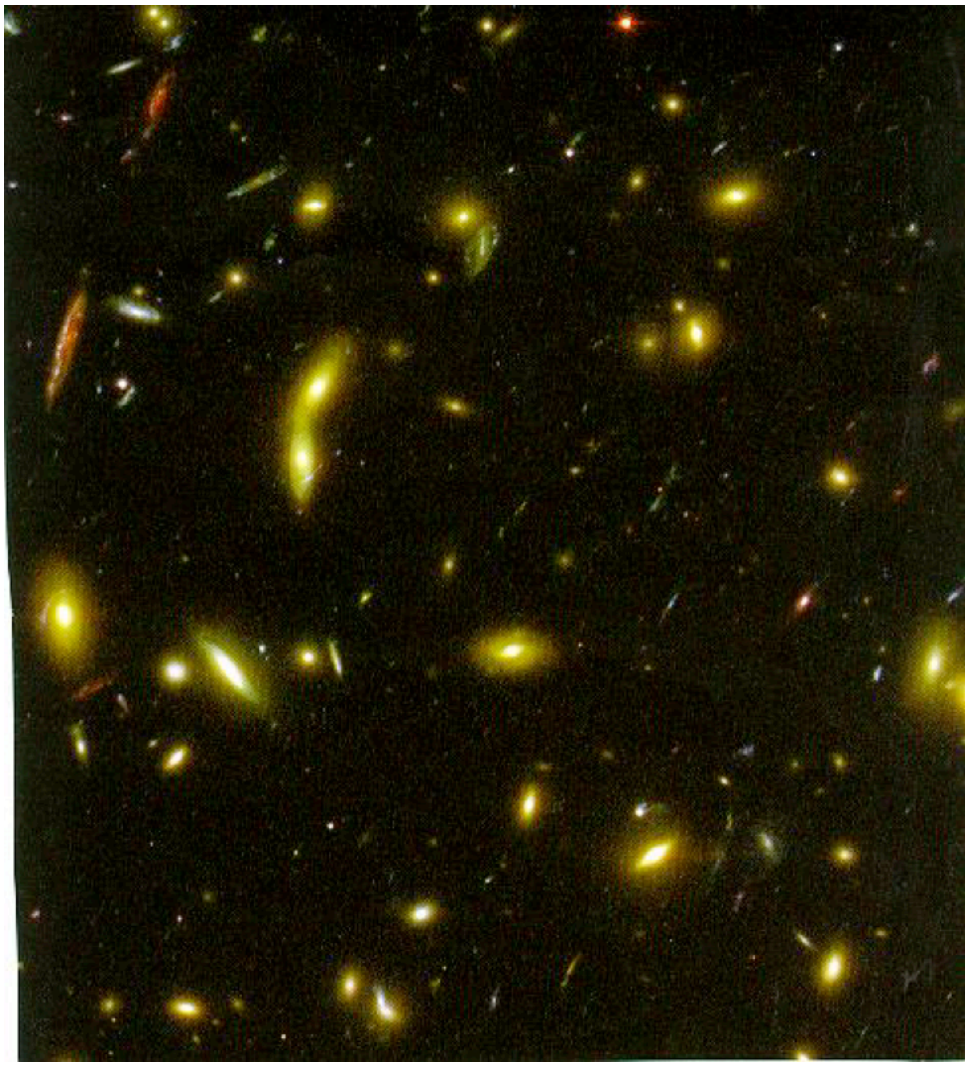

Figure 1: *The 20th century astrophysics and cosmology assumed that intergalactic space is empty, thus being described by Minkowski spacetime and special relativity. In this paper, we point out that the entire universe can be seen from each of its points. But light carries energy, thus causing a local energy density. Consequently, intergalactic space is a true physical medium of low density causing a decrease of the speed of light that increases with the distance, thus eliminating the expansion of the universe and its increase with the distance.*

1) It has been proved that the indicated "argument" cannot provide a *numerical* representation of the rather large decrease of the speed of light in water, that is of the order of 33 %, i.e.,

$$C_{water} \approx \frac{c}{3}, \quad n = 3. \tag{2}$$

In fact, actual calculations show that the scattering of photons through water molecules can at best account for a few percentage changes of the value in vacuum.

2) The reduction to photon is indeed possible for light, but it has no physical value for electromagnetic waves at large, such as radio waves with one meter in wavelength, that also experience the same reduction of speed as that of light when propagating within physical media, as established by vast evidence, including the decrease of the pitch of radio waves from satellites when passing through planetary atmospheres.

3) Any attempt at salvaging special relativity within transparent physical media such as water causes catastrophic inconsistencies. For instance, if one assumes the speed of light *in water* as the maximal causal speed, there is the violation of causality for electrons traveling in water faster than the local speed of light (Cerenkov effect). Alternatively, if one assumes the speed of light *in vacuum* as the maximal causal speed in water, causality is salvaged, but there is the violation of the fundamental law of the relativistic sum because the sum of two speeds of light in water does not yield the speed of light in water.

4) In the absence, not only of a decrease of the speed of light, but of different decreases for different frequencies f, Newton's spectral decomposition of light would be impossible. In fact, explicit calculations show the inability of the scattering of photons to represent the large decrease of the speed of light within the *surface* of a crystals. The impossibility of explaining the spectral decomposition of light becomes evident, e.g., because said decomposition occurs within a layer at the surface so thin to render irrelevant the scattering of photons.

5) Rather vast experimental evidence (see Refs. [42-61] and Section 6.1, Ref. [30d]) has established the existence of electromagnetic waves propagating at (group) speeds *bigger* than the speed in vacuum, in which case the reduction to photons does not achieve the objective of salvaging special relativity for conditions it was not intended for. In this case, rather than

conducting a serious scrutiny, organized interests on Einsteinian doctrines essentially ignore the direct and indirect experimental evidence of electromagnetic waves propagating at group speeds bigger than c.

In this paper, we assume that the speed of light is indeed c and is indeed constant in vacuum, but we resume the use of the historical law (1) for the propagation of light within physical media with the specification its speed is *smaller* than c for transparent media of low density (such as liquids, planetary atmospheres or astrophysical chromospheres), and it is *bigger* than c for physical media of high density (such as for the interior of hadrons, stars and black holes).

The physical interpretation of the latter assumptions is elementary, and essentially consists in *light losing energy (or frequency) to the medium* for the case of media with low densities, and *light acquiring energy (frequency) from the medium* for the case of hyperdense media. In particular, we shall assume that

$$C_{d=0} = c, \quad n_{d=0} = 1. \tag{3}$$

namely, that the speed of light is recovered uniquely and identically for physical media with null energy density, as expected for the vacuum intended as absence of any physical entity, whether matter or light.

3. Lack of expansion of the universe.

Recall that the cosmological redshift z is defined by (see, e.g., Ref. [9])

$$z_{cosm} \;=\; f_{emis} - f_{observ}, \tag{4}$$

and it has been interpreted throughout the 20th century as being due to the Doppler shift

$$f_{emis} = \gamma^{-1} f_{observ} \approx 1 - \beta + ... \tag{5a}$$

$$\gamma = (1 - \beta^2)^{-1/2}, \quad \beta = v/c, \tag{5b}$$

where v is the expansion speed, that yields the well known expression

$$z \;=\; \beta = v/c. \tag{6}$$

Space can be considered as being empty only at small distances in astronomical scale, such as interplanetary distances, while *space is indeed a*

physical medium at intergalactic distances. In fact, the entire universe can be observed from any of its points. Hence, each point of intergalactic spaces is traversed by light originating from all of the universe, thus producing a local energy density d different than zero. Additionally, space is full of cosmic rays, hydrogen and matter that, again at intergalactic distances, contribute for space being a transparent physical medium with *cosmological speed of light and index of refraction*

$$C_{cosm} = \frac{c}{n_{cosm}(r, f, d, \tau, ...)} \tag{7}$$

The admission of the local character of the speed of light due to space as a physical medium at intergalactic distances, eliminates any need for the expansion of the universe. In fact, we assume the limit case of no expansion at all,

$$v = v_{exp} = 0. \tag{8}$$

As a result, the cosmological redshift cannot any longer be interpreted as due to the Doppler's shift. However, by recalling the expression $\lambda f = c$, it is easy to see that the cosmological redshift can be numerically represented in its entirety via the new law

$$z = \frac{c}{\lambda}(1 - \frac{1}{n_{cosm}}). \tag{9}$$

hereinafter called *cosmological isoredshift* referred, specifically, to a *redshift of light not due to relative motion,* the prefix "iso" originating from the novel underlying mathematics and relativity known as *isotopies* in the Greek meaning of preserving the original axioms.

Needless to say, cosmological isoredshif (9) does not exclude a small expansion of the universe, as it is expected to be the case for the gravitational *repulsion* between matter and antimatter galaxies [31]. The same model does not exclude a small contraction of the universe, as expected from the gravitational *attraction* between matter galaxies. However, expansion and contraction should be of such a minimal value and of anisotropic character not implying the Middle Age belief that Earth is at the center of the universe,

Recall that the cosmological isoredshift deals with a *decrease of the frequency* of light, with consequential *decrease of the energy,* and we shall write

from Eq. (4)

$$\Delta E_z \;=\; E_{emis} - E_{observ} = hf_{emis} - hf_{observ} = h\frac{c}{\lambda}(1 - \frac{1}{n}). \qquad (10)$$

It is evident that the loss of energy by light is proportional to the distance. Consequently, *cosmological model (9) automatically implies the increase of the redshift with the distance, by therefore eliminating the need for the increase of the expansion with the distance.*

To have an explicit illustration, we introduce as a working assumption a functional dependence of the cosmological index of refraction of the type

$$n_{cosm} = \frac{1}{1 - Nrfd\tau..} \qquad (11)$$

where N is a positive constant, under which cosmological isoredshift (9) becomes

$$z_{cosm} = \frac{c}{\lambda}\, Nrfd\tau..... \qquad (12)$$

thus verifying Hubble's law for wavelengths essentially assumed as a constant due to the relatively small variations for the visible light. We then have the following structural expression for the Hubble constant

$$H_o = \frac{c}{\lambda}\, N \approx\; 70(km/sec)Mpc. \qquad (13)$$

Additionally, the model produces a dependence of the cosmological isoredshift on the frequency as well as wavelength of light, the energy density of space, its temperature and other characteristics.

Needless to say, model (11) is merely submitted as an illustration, by keeping in mind that the actual functional dependence of the cosmological index of refraction may well be of a complexity beyond our imagination at this writing.

Finally, *isoredshift (9) also explains the cosmologic microwave background radiation* without any need for the big bang [2b] because the energy lost by light to the medium has to be released in the only possible form, that of radiation.

4. Lack of dark matter

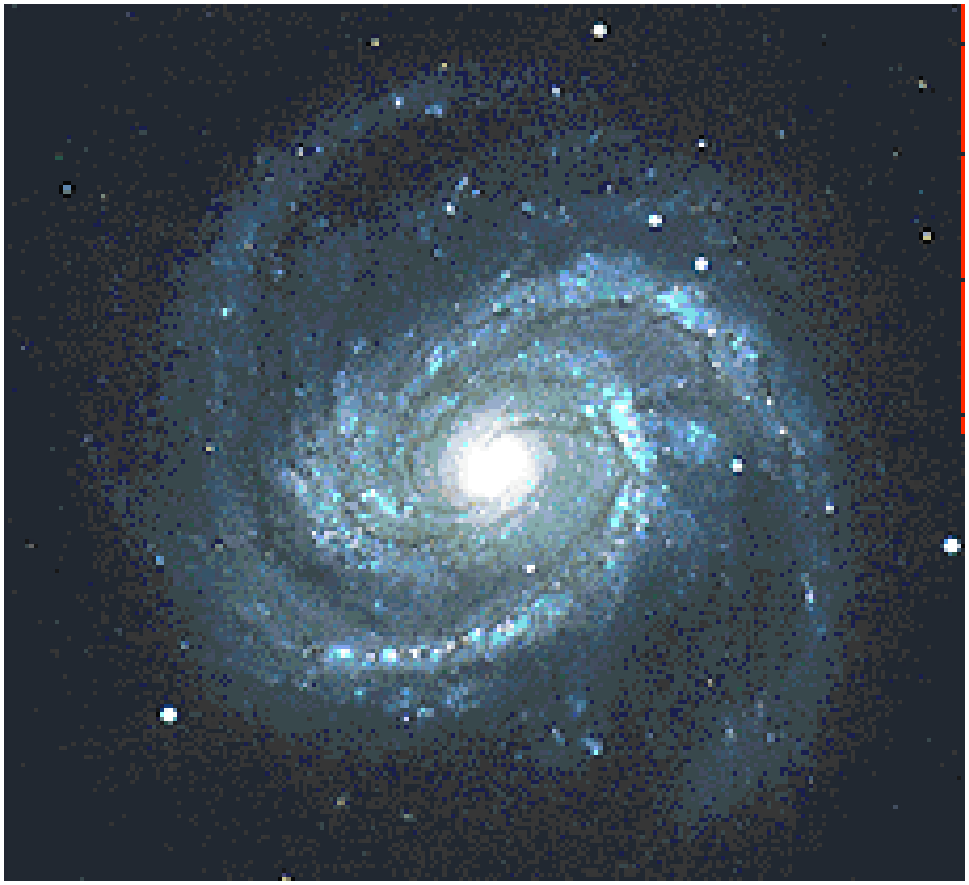

Figure 2: *The 20th century astrophysics and cosmology assumed that interstellar space inside a given galaxy is empty, thus verifying special relativity. In this paper, we point out that space within a galaxy is filled up with matter whose density decreases with the radial distance from the center, thus causing a slowdown of the speed of light that decreases with the increase of the distance, thus eliminating the need for dark matter (see Figure 3).*

The hypothesis of dark matter originated from anomalous behavior of peripheral stars in a galaxy as compared to stars in its interior [9,11]. But the only means for measurements of far away stars available on Earth is light. Therefore, said anomaly is, again, derived from anomalous differences between the redshift of exterior and interior stars in a given galaxy.

It is easy to see that space within a given galaxy is indeed a physical medium, actually with much bigger energy density than intergalactic space. Therefore, cosmological isoredshift (9) applies identically for stars belonging to a galaxy, and we shall write

$$C_{galac} \ = \ \frac{c}{n_{galac}(r, f, d, \tau, ...)} \tag{14}$$

with *galactic isoredshift* for the case of stars having null radial speed with respect to Earth (e.g., as in Figure 2)

$$z_{galac} \ = \ f_{emis} - f_{observ} = \frac{c}{\lambda} \ (1 - \frac{1}{n_{galac}}). \tag{15}$$

The plot of the anomalous behavior of stars (line B of Figure 3) can be achieved via a plot of galactic index of refraction n_{galac}.

However, stars belonging to a galaxy do have speeds toward and away from Earth. Consequently, the general case of galactic dynamics belongs to the anomalous *isodoppler redshift,* hereon referred to a redshift due to a combination of a conventional redshift caused by relative motion and a redshift caused by physical media, that is considered for study in a subsequent paper.

5. Lack of universality of Newton gravitation.

Another origin of the scientific obscurantism in the 20th century astrophysics and cosmology has been the adaptation of the universe to Newton's law of universal gravitation

$$F = g\frac{m_1 m_2}{r^2} \tag{16}$$

where g is the familiar gravitational constant.

Contrary to a popular belief since the appearance of Newton's *Principia* in 1687, *Newton's gravitational law is not universal because it solely applies*

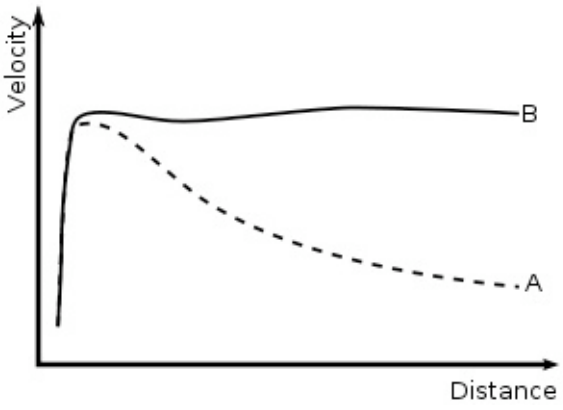

Figure 3: *The deviation of the observed behavior of the speed of stars in a spiral galaxy (B) from that predicted from Newtonian gravitation (A) has been derived via the redshift of light. Therefore, it can be explained via a progressive decrease of the speed of light caused by the media with decreasing density from the galactic center (Figure 2).*

for masses while, in reality, gravitation is indeed universal, thus including light, as suggested by Newton himself, but thereafter ignored.

Consequently, the author has modified in Ref. [30c] Newton's law into a form that is indeed universal because including light, In fact, under the redefinition of the gravitational constant permitted by the equivalence principle

$$s = \frac{g}{c^4},\ m_k = \frac{E_k}{c^2},\ k = 1, 2, \tag{17}$$

we have the following *law of universal gravitation*

$$F = s\frac{E_1 E_2}{r^2}, \tag{18}$$

according to which *gravitation is originated by energy of a body and not by its mass,* since energy is unique, while mass varies whether one studies the exterior or interior gravitational problem, gravitational or inertial mass, etc. Additionally, as we recall in Section 7, the source in Einstein-Hilbert field equations is given by *energy,* and not by mass.

The consequences of the additional adaptation of the universe to Newton's original conception (16) have been far reaching. We mention here the

fact that the notion of curvature of space became accepted in the early part of the 20th century following the detection of the bending of light passing near the Sun. In turn, the advent of curvature caused problems of truly historical proportions, such as the impossibility of achieving a consistent quantum version of gravity, the impossibility of formulating an axiomatically consistent grand unification of electroweak and gravitational interactions, and many other unsurmontable problems (see monograph [30a] for details).

In reality, once Newton's law is formulated in a truly universal way, it is easy to see that the bending of light is a purely *Newtonian* effect. In fact, light does carry energy $E = hf$ and, therefore, must be attracted by any gravitational field. Assuming for $E_1 = E_{Sun}$ the total energy of the Sun, the bending of light when passing near the Sun is then due to the law

$$F = s\frac{E_{Sun}(hf)_{light}}{r^2}, \tag{19}$$

thus eliminating its historical use as evidence for the curvature of space, with the clear understanding that the Riemannian treatment of gravity remains a *mathematically* beautiful theory (see Refs. [30c] for details).

Despite its simplicity, the astrophysical implications of universal gravitation (18) are deep indeed. As an indication, the reformulation requires a necessary revision of the *mass* of the Sun and the planets as currently assumed from planetary data. This is expected from the inapplicability for extended and hyperdense planetary bodies of the equivalence principle for point masses discussed in Section 8. According to these new vistas, the *energy* of the Sun and of the planets can be uniquely set via law (18) from planetary data, but the corresponding masses remain unknown at this writing due to lack of knowledge of the maximal causal speed in the interior of the indicated bodies.

It is evident that *once Newton's law is expressed in a truly universal form, all distinctions between "dark matter" and "dark energy" cease to have physical meaning.* Nevertheless, Section 4 was devoted to the lack of dark matter as conventionally understood, while the lack of dark energy, also as conventionally understood, requires a new physics indicated in the subsequent sections.

6. Isorelativity.

Another reason for the scientific obscurantism in astrophysics and cosmology of the 20th century is the widespread belief that a relativity theory can solely be formulated for empty space and, consequently, special relativity is the sole relativity valid for the entire universe to the end of time.

In reality, we have nowadays a rather vast experimental evidence [28-65] that *physical media cause an alteration, called mutation, of the very structure of spacetime,* that is an incontrovertible consequence of the alteration of the speed of electromagnetic waves. By recalling that the Minkowski spacetime is homogeneous and isotropic, the biggest mutations of spacetime are expected for inhomogeneous and anisotropic physical media, such as planetary atmospheres or astrophysical chromospheres, contemplated for a detailed study in a subsequent paper.

The empirical study of the cosmological isoredshift (9), the bending of light (19) due to Newtonian attraction, and related issues, without the rigorous backing of a covering relativity, is insidious because it could lead to a second generation of obscurantism, that of an apparent rigorous character while in reality dealing with merely empirical formulations.

The author has spent his lifetime of research for the construction of a covering of special relativity applicable to physical media while recovering special relativity identically and uniquely when motion returns to be in vacuum [28-31]. The covering relativity is today known as *Santilli's isospecial relativity,* or *isorelativity* for short, where the prefix "iso" is used in the Greek meaning of preserving the axioms of special relativity and merely providing a broader realization.

Thanks to a new mathematics today known as *Santilli isomathematics* [41], including a covering of Lie's theory known as the *Lie-Santilli isotheory* [72-76], isorelativity has indeed achieved the universal symmetry of locally varying speeds of light (1), today known as the *Lorentz-Poincaré-Santilli isosymmetry* [66-69].

Regrettably, we cannot possibly review these mathematical, theoretical and experimental studies and have to refer the serious scholar to monographs [28-31] and papers quoted therein (for a general bibliography in the field, one may inspect Ref. [79]). For minimal selfsufficiency, we recall that the conventional Minkowski spacetime

$$M(x,\eta,R): x=(x^1,x^2,x^3,t), \eta=Diag./(1,1,1,-c^2) \qquad (20)$$

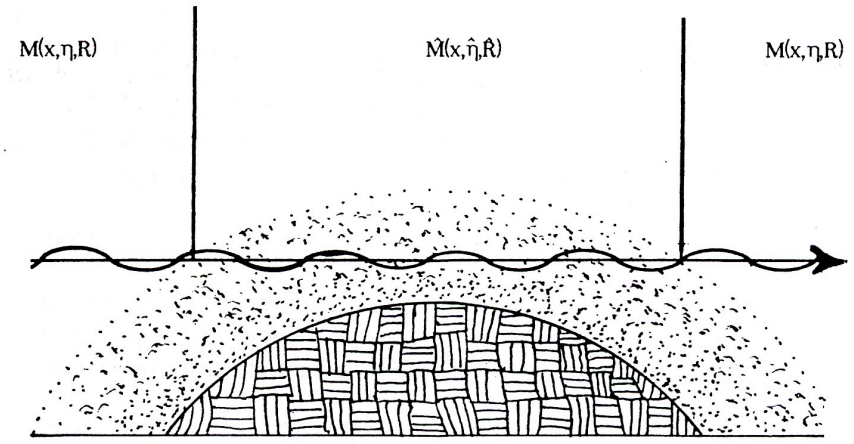

Figure 4: *A schematic view of the conditions of applicability of the Minkowski-Santilli isospacetime, that within physical media such as Earth's atmosphere, while recovering uniquely and identically the conventional Minkowski spacetime in vacuum.*

can be formulated over the field of real numbers R characterized by the unit $I = Diag.(1, 1, 1, 1)$ of the Lorentz symmetry, in which case the basic invariant is written

$$x^2 = (x^\mu \eta_{\mu\nu} x^\nu) I = (x_1^2 + x_2^2 + x_3^3 - c^2 t^2) I, \tag{21}$$

with fundamental symmetry, the *Lorentz-Poincaré symmetry*

$$P(3.1) = SO(3.1) \times T(3.1) \times I(1), \tag{22}$$

where $I(1)$ will be recalled shortly.

The mutated spacetime of isorelativity is given by the *Minkowski-Santilli isospace* [32] that, in its simplest possible form, can be written

$$\hat{M}(x, \hat{\eta}, \hat{R}) : \quad x = (x^1, x^2, x^3, t), \tag{23a}$$

$$\hat{\eta} = Diag.(1/n_1^2, 1/n_2^2, 1/n_3^2, -c^2/n_4^2) =$$
$$= T(t, r, v, d, \tau, ...)\eta = (T_\rho^\alpha \eta_{\alpha\nu}), \tag{23b}$$

with isoinvariant

$$x^{\hat{2}} = (x^\mu \hat{\eta}_{\mu\nu} x^\nu)\hat{I} = (\frac{x_1^2}{n_1^2} + \frac{x_2^2}{n_2^2} + \frac{x_3^2}{n_3^2} - t^2 \frac{c^2}{n_4^2})I, \tag{24a}$$

$$\hat{I} = \hat{I}^\dagger = T^{-1} > 0,\ n_\nu > 0,\ \nu = 1, 2, 3, 4. \tag{24b}$$

where T is called the *isotopic element,* its inverse $\hat{I}$ is called the *isounit,* the cosmological light speed is now given by

$$C_{cosm} = \frac{c}{n_{cosm}},\quad n_{cosm} = n_4. \tag{25}$$

The quantities ns in the above expressions are called the *characteristic quantities* of the medium considered. The above isospacetime allows the representation directly with a metric of:

1) *Arbitrary speed of light* $C = c/n_4$ within physical media [42-59];

2) The *actual dimension and shape* of an astrophysical object via the isospace components $n_k, k = 1, 2, 3$ normalized to the value $n_k = 1$ for the vacuum;

3) The *density* of the medium considered via the isotime component n_4 also normalized to the value $n_4 = 1$ for the vacuum;

4) The *inhomogeneity* of the physical medium considered via, e.g., a dependence of the characteristic quantities on the distance and other variables, $n_\nu = n_\nu(r, ...)$;

5) The *anisotropy* of physical medium considered via different values of the characteristic quantities, e.g., $n_4 \neq n_3$.

It is evident that isoinvariant (24) is "directly universal" for all possible spacetimes in (3.1)-dimensions, in the sense that it admits as particular cases the Minkowskian, Riemannian, Finslerian and other spacetimes (universality) directly in the coordinates of the experimenter without any coordinate transformation (direct universality).

The Minkowski-Santilli isogeometry [39] is equipped with the conventional machinery of the Riemannian geometry (covariant derivatives, Christoffel's symbols, etc.), by therefore unifying the Minkowskian and Riemannian geometries. However, we are here dealing with an axiom-preserving isotopy for which $\hat{M}$ isomorphic to M, thus being *isoflat,* that is, flat on isospace over the isofield.

The universal isosymmetry of isoinvariant (24) has been extensively studied for the first time by Santilli with references to: the isotopies of the classical [32] and operator [33] Lorentz symmetry; the isotopies of the rotational symmetry [34]; the isotopies of the SU(2) spin symmetry [35]; the isotopies of the Poincaré symmetry [36]; and the isotopies of the spinorial covering of the Poincaré symmetry [37,38].

We cannot possibly review here this body of studies, and we limit ourselves to the indication of the isotopic covering *Lorentz-Santilli isoboosts* first studied in Refs. [32,33] of 1983, here presented for the case in (3,4)-plane

$$x'^1 = x^1, \quad x'^2 = x^2, \tag{26a}$$

$$x'^3 = \hat{\gamma}\ (x^3 - \hat{\beta}\ \frac{n_4}{n_3}\ x^4), \tag{26b}$$

$$x'^4 = \hat{\gamma}\ (x^4 - \hat{\beta}\ \frac{n_3}{n_4}\ x^3), \tag{26c}$$

$$\hat{\gamma} = \frac{1}{\sqrt{1 - \hat{\beta}^2}}, \tag{26d}$$

$$\hat{\beta} = \frac{v_s}{c}\ \frac{n_4}{n_s}. \tag{26e}$$

The resulting covering Lorentz-Poincaré-Santilli isosymmetry can be written (see monograph [29b] for a comprehensive treatment)

$$\hat{P}(3.1) = \hat{SO}(3.1) \times \hat{T}(3.1) \times \hat{I}(1), \tag{27}$$

and it is *eleven dimensional,* the 11-th dimensionality being given by the new *isotopic invariance*

$$(x^\mu \eta_{\mu\nu} x^\nu) I \equiv [x^\mu (w^{-1} \eta_{\mu\nu}) x^\nu)(wI) = (x^\mu \hat{\eta}_{\mu\nu} x^\nu)\hat{I}. \tag{28}$$

In this way Santilli proved for the first time in ref. [36] that, contrary to a rather popular belief, *the Poincaré symmetry is eleven dimensional,* of course, when the invariant is properly formulated as in Eq. (21). The discovery of this additional spacetime symmetry has stimulated truly momentous advances, such as the achievement of a consistent operator formulation of gravity [65], an axiomatically consistent grand unification [66,67], and other advances.

Note that, by conception and constriction, $\hat{P}(3.1)$ is isomorphic to $P(3.1)$. Hence, *isorelativity is a completion of special relativity much along the historical E-P-R argument* [7]. Also, as shown by the 11-th invariance (27), arbitrary speeds of light are "hidden" in conventional special relativity, much along the theory of "hidden variables."

The lack of discovery of these advances until recently should not be surprising because said advances required the prior discovery of *basically new numbers,* Santilli's isonumbers with an arbitrary unit [40].

The identification of the universal isosymmetry of all possible isoelement (24) has permitted the axiom-preserving isotopic lifting of all aspects of special relativity that are at the foundations of Santilli's isorelativity, and we cannot possibly review here. We merely recall for minimal selfsufficiency of this paper its basic isoaxioms for motion along the space direction s (see monograph [29b] for detailed treatment of the general case):

ISOAXIOM I: The maximal causal speed within physical media is given by

$$\hat{V}_{max} = c\ \frac{n_s}{n_4}. \tag{29}$$

ISOAXIOM II: The addition of speeds within physical media follows the isotopic law

$$\hat{V}_{Tot} = \frac{v_1 + v_2}{1 + \frac{v_1 v_2}{c^2}\ \frac{n_4^2}{n_s^2}}. \tag{30}$$

ISOAXIOM III: The dilation of time and the contraction of space within physical media follow the isotopic laws

$$\hat{t}' = \hat{\gamma}\ t, \tag{31a}$$

$$\ell' = \hat{\gamma}^{-1}\ \ell, \tag{31b}$$

ISOAXIOM IV: The isodoppler frequency shift follows the law

$$\hat{\omega}' = \frac{1 - \hat{\beta}\ cos(\hat{\alpha})}{\sqrt{1 - \hat{\beta}^2}}, \tag{32}$$

with approximate expression for $\hat{\alpha} = 0$ and v_s/c very small

$$\hat{\omega}' = \omega\ (1 - \hat{\beta} + \frac{1}{2}\ \hat{\beta}^2 + ... \tag{33}$$

where, for certain geometric reasons, the isoaberration angle is given by $\hat{\alpha} = \alpha\ n_s$

ISOAXIOM V: The mass-energy isoequivalence within physical media follows the isotopic law

$$\hat{E} = m\ V_{max}^2 = mc^2\ \frac{n_s^2}{n_4^2}. \tag{34}$$

A few comments are now in order. Before venturing the usual judgments following a glance, serious readers are suggested to study the technical treatment of isorelativity [28-31] with particular reference to the proof of the "direct universality" of the Lorentz-Poincaré-Santilli isosymmetry, and consequential direct universality of the Isoaxioms I-V. In fact, all various anomalous departures from special relativity existing in the literature have been proved to be particular cases of Santilli's isoaxioms and originate from different expansions in terms of different parameters, as proved by J. V. Kadeisvili [63], A. K. Aringazin [64], and others. Therefore, *Isoaxioms I-V are the only possible under a universal isosymmetry for arbitrary speeds of light.*

The serious reader is then suggested to study the experimental verifications of isorelativity and related isoaxioms in particle physics, nuclear physics, superconductivity, chemistry, biology, astrophysics and cosmology (see, e.g., monograph [30d] and papers quoted therein). In this way, the serious reader will learn *the necessity of abandoning the speed of light as the maximal causal speed within physical media* because of unsurmontable difficulties, the understanding being that the speed of light is indeed regained as maximal causal speed, but only in empty space. Particularly instructive is the verification that the maximal causal speed (29) permits the resolution of the inconsistencies of special relativity within water indicated in Section 2.

Another possible misrepresentation, that remains generally unnoticed by the non-expert reader, is the dubbing of the characteristic quantities n_ν as "free parameters" while in reality they are actual physical quantities that can be *experimentally measured.* This misrepresentation is generally due to the novelty of the invariant representation of shapes and densities via the geometry of spacetime that were completely absent in the physics, astronomy and cosmology of the 20th century. For instance, in the case of the

neutron, the space characteristic quantities must represent a spheroid ellipsoid contained within a sphere of 1 fm radius since an arbitrary value (that would be admitted in case of a parameters) leads to evident inconsistencies, while the time characteristic quantity n_4 must represent the actual density of the neutron (as the ratio of its rest energy divided by its volume) with an ensuing $V_{\max}$ necessarily bigger than c. Similarly, for the Bose-Einstein correlation, the characteristic quantities define the "fireball" of the $p-\hat{p}$ annihilation which is a very elongated ellipsoid, while other characterizations would lead to deviations from experimental data.

We are now in a position to better clarify the difference between *isoshift* and *isodoppler shift.* The isoshift refers to a variation of frequency of electromagnetic waves traveling within transparent physic al media without any relative motion between the observer and the source, which isoshift can be an *isoredshift* when energy is lost to the medium, or an *isoblueshift* when energy is gained from the medium. The isodoppler shift is a variation of the frequency of electromagnetic waves traveling within transparent physical media when there exists a relative motion between the observer and the source, which isodoppler shift can also be an *isodoppler redshift* or an *isodoppler blue shift* depending on whether energy is lost to and gained from the medium as well as the source moves toward or away the observer (combined actions that, in principle, can also cancel each otehr).

The cosmological isoredshift (9) is the simplest possible case in which there is *no* relative motion between galaxies and Earth. Nevertheless, we should stress again that this is merely a limit case setting up the foundations of isocosmology, because a local expansion or contraction of the universe is indeed admitted, but always in such a way not to be isotropic with respect to Earth.

In fact, *matter galaxies* and, separately, *antimatter galaxies* are expected to *attract* each other, thus leading to a local contraction of the universe over very long periods of time. By comparison, *matter and antimatter galaxies are expected to repel each other* as established by the *isodual theory of antimatter* [31] for which the transition from matter to antimatter is characterized by the *isodual map* here expressed for a generic quantity

$$Q(t,r,d,f,...) \ \rightarrow \ Q^d(t^d,r^d,f^d,d^d,...) =$$

$$= -Q^\dagger(-t^\dagger,-r^\dagger,-f^\dagger,...) = -Q^t(-t,-r,-f,-d,...), \qquad (35)$$

where the upper letter t denotes transposed.

To avoid catastrophic inconsistencies originating from the possible mixing of matter and antimatter mathematics, the isodual map must be applied to the totality of quantities used for matter and all their operations. Hence, isoduality implies not only the reversal of the sign of the charge, but also that of all other quantities, such as time, frequency, energy, etc., and results to be equivalent to charge conjugation at the operator level. Consequently, the isodual theory of antimatter represents all classical and quantum experimental evidence on antimatter.

Note that the isodual map must be also applied to the basic units, thus rendering negative quantities physically acceptable. For instance, negative time, frequency and energy referred to negative units are as causal as positive time, frequency and energy when referred to positive units.

The isodual theory of antimatter characterizes the *isodual special relativity* for point antimatter in vacuum and its covering *isodual isospecial relativity* for extended antimatter with universal *Lorentz-Poincaré-Santilli isodual isosymmetry*

$$\hat{P}^d(3.1) = \hat{SO}^d(3.1) \times \hat{T}^d(3.1) \times \hat{I}^d(1), \tag{36}$$

We assume the reader is aware of the fact that no serious or otherwise quantitative study of antimatter was conducted by the astrophysics and cosmology of the 20th century because of the impossibility by special and general relativities to provide any differentiation between *neutral* matter and antimatter. The case of charged classical antimatter is afflicted by various insufficiencies. The isodual theory of antimatter has resolved this historical imbalance thanks to a new mathematics, the *isodual mathematics* [41] that permits the treatment of antimatter at all levels, exactly as it is the case for matter, from Newton to second quantization.

Additionally, the isodual theory of antimatter permits, for the first time in history to our knowledge, the possibility of ascertaining whether a far away star, quasar or galaxy is made up of matter or of antimatter, because antimatter emits a new light, *the isodual light,* possessing experimentally verifiable differences with respect to the ordinary light emitted by matter. In particular, *the isodual light emitted by a far away antimatter galaxy or quasar must be repelled by Earth's gravitational field,* thus permitting the initiation of the new field of *antimatter astrophysics and cosmology.*

7. Exterior and interior isogravitation.

As indicated in the preceding section, the Minkowski-Santilli isogeometry unifies the Minkowskian and the Riemannian geometries [39] and differentiates them via different explicit realizations of topologically equivalent (positive-definite) isounits. Therefore, *isorelativity unifies special and general relativities* to such an extent that it incorporates gravitation in the Isoaxioms I-V without any additional. formalism.

Due to the preservation of the machinery of the Riemannian geometry, the Minkowski-Santilli isogeometrry allows the preservation of the Einstein-Hilbert field equations

$$G_{\mu\nu} = R_{\mu\nu} + g_{\mu\nu}R = kS_{\mu\nu}, \tag{37}$$

although with a new energy-momentum tensor $S_{\mu\nu}$ as a source tensor *of first order in magnetude* that is necessary to admit, as a particular case, the "universal Newtonian gravitation" as per Eq. (18) (see memoir [77] and monographs [30a,30c,30d] for numerous additional reasons, including the entire origin of exterior gravitation from the electromagnetic field of the elementary particles constituting the body considered, beginning with the evident case of the electron, and then passing to mesons, hadrons, nuclei, etc.). Additionally, one should keep in mind that, when Eqs. (37) are formulated in the Minkowski-Santilli isogeometry, they lose all curvature in favor of isoflatness.

Note that the sources of the Einstein-Hilbert field equations are given by *energy*-momentum tensors and not a *mass*-momentum tensor, in full agreement with universal gravitation (18).

The formulation of gravitation without curvature, known as *isogravitation,* was first presented by Santilli at the *Seventh Marcel Grossmann Meeting on Gravitation* of 1992 [65]. It is given by the factorization of a Riemannian metric $g(x)$ into the Minkowski metric η and a 4×4-dimensional, positive-definite metric T,

$$g(x) = T_{gr}(x) \times \eta \equiv \hat{\eta}, \tag{38}$$

plus the assumption of its *inverse* as the basic isounit of the theory,

$$\hat{I}_{gr}(x) = 1/T_{gr}(x) \tag{39}$$

Since the entire gravitational content is represented by the isotopic element T, the formulation of Eqs. (37) with respect to an isounit that is the inverse of the gravitational content, eliminates curvature while preserving the basic equations of the theory.

As an illustration, the *exterior isogravitation* for the case of the Schwartzschild metric is characterized by the isotopic element

$$T_{grav} = Diag.\{(1 - \frac{2\ m}{r})^{-1}, (1 - \frac{2\ m}{r})^{-1},$$

$$(1 - \frac{2\ m}{r})^{-1}, (1 - \frac{2 \times m}{r})\}. \tag{40}$$

Additionally, isorelativity admits the *interior isogravitation* with models of the type

$$T_{grav} = Diag.\{(1 - \frac{2\ m}{r})^{-1}/n_1^2, (1 - \frac{2\ m}{r})^{-1}/n_2^2,$$

$$(1 - \frac{2\ m}{r})^{-1}/n_3^2, (1 - \frac{2 \times m}{r})/n_4^2\}. \tag{41}$$

that, again, allow for the first time to represent the local speed of light, the shape and density of the astrophysical body, its expected inhomogeneity and anisotropy, etc. all with the same geometry and isosymmetry used for exterior gravitation.

In particular, *gravitational singularities (black holes)* are represented by the following limits

$$Lim\hat{I}_{gr}(r)_k^k = 0, \quad Lim\hat{I}_{gr}(r)_4^4 = \infty, \tag{42a}$$

$$LimT_{gr}(r)_k^k = \infty, \quad LimT_{gr}(r)_4^4 = 0, \tag{42b}$$

A few comments are now in order. The most important feature of isogravitation, for which the theory was constructed, is that *gravitation is characterized by a universal isosymmetry, the Lorentz-Poincaré-Santilli isosymmetry,* thus resolving the catastrophic inconsistencies of the conventional Riemannian gravitation caused by "covariance" [25]. In turn, the studies have established that the achievement of a universal symmetry for all possible Riemannian line elements requires the necessary abandonment of curvature in favor of isoflatness.

The reader should be aware that, despite the simplicity of rules (37), (38), the implications of isogravitation are far reaching, and much deeper than the mere elimination of curvature of space. For instance, *the time of an astrophysical body characterized by isogravitation is, in general, dramatically different then our time on Earth.* Suppose that $t = t\ I_t$ is our time referred to the unit $I_t = 1\ sec$ (in dimensionless form). The time of an astrophysical body with gravitational isotopic element T is the *isotime* $\hat{t} = t\ \hat{I}_t$ now referred to the isounit of time $\hat{I}_t = (T_4^4)^{-1}$. Since $\hat{I}_t$ is generally different than $I_t = 1\ sec$, *astrophysical bodies with different gravitational fields evolve according to generally different times.* Hence, the evolution of a given astrophysical body we may perceive with our time on Earth can be, in general, dramatically different than the reality.

Additionally, *isogravitation implies that the dimension of a gravitational singularity is indeed null, Eq. (42), but in addition time becomes infinite* (because the time unit $\hat{I}_t = \hat{I}_4^4$ is divergent. In this case, the entire physics of the 20th century has no sense whatsoever inside black holes, as expected from their extreme complexities. This implies that any claim of the continued validity of the speed of light c inside the black hole, or the continued claim of energy equivalence of a black hole $E = m\ c^2$ becomes offensive to scientific reason because the selection of the appropriate generalization should indeed be the subject of debates, but not their need.

Additionally, another reason for the scientific obscurantism in astrophysics and cosmology of the 20th century is the abandonment of the distinction between exterior and interior gravitational problems, as a consequence of which gravitational collapse, that is a strictly *interior* problem, was solely studied via *exterior* models such as model (39). This additional imbalance is resolved by isorelativity because of its treatment of both exterior and interior problems. Consequently, gravitational limits (42) must be referred to solutions of *interior* models such as (41), since the study of black holes via the exterior problem only may eventually result to provide a mere illusion of physical rigor.

Isogravitation has been mentioned in this paper because any isotopic mutation of spacetime, as expected in high energy scattering regions, inevitably implies generalized metrics with a coordinate dependence, thus bringing into focus (for the first time to our knowledge) gravitational contributions in high energy scattering events, with the understanding that

their value is much smaller than that of other interactions.

8. Lack of dark energy

Yet another reason for the scientific obscurantism afflicting astrophysics and cosmology of the 20th century is the rather widespread assumption of the validity of Einstein's equivalence principle

$$E \ = \ mc^2, \tag{43}$$

throughout the universe, expectedly, until the end of time without any scrutiny, thus adapting the universe to a preferred theory.

Needless to say, the equivalence principle is indeed valid for the conditions of its original conception and experimental verification, *point-like particles moving in vacuum,* such as particles in accelerators. However, the assumption of the same principle without any experimental evidence for *extended bodies* becomes a theology. Point particles have no dimension. Consequently, their maximal causal speed is the speed of light in vacuum c. By contrast, extended bodies are generally opaque to light, thus rendering meaningless the use of c as the maximal causal speed.

In any case, the assumption of principle (43) for extreme conditions existing in the universe, such as for the energy equivalence of black holes, becomes a pure machination intended to preserve special relativity under conditions immensely different than the rather simplistic conditions of its original conception and verification.

It is at this point where the need for the rigorous guidance of a covering relativity becomes mandatory to prevent endless trials and errors. Recall the direct universality of isorelativity and the experimental evidence in particle physics, nuclear physics, astrophysics and other fields [29,30] according to which the maximal causal speed within hyperdense matter (such as in the interior of hadrons, nuclear and stars) is *bigger* than the speed of light in vacuum, with consequential bigger values of the energy equivalence. Recall also that the covering Lorentz-Poincaré-Santilli isosymmetry characterizes the *light isocone* (the light cone on isospace $\hat{M}$ over the isofield $\hat{R}$), e.g., in the $(3,4)$-space

$$x^{\hat{2}} = \frac{x_3^2}{n_3^2} \ - \ t^2 \ \frac{c^2}{n_4^2} = 0, \tag{44}$$

from which maximal causal speed (29) follows.

Dark energy is then eliminated by merely noting that the *average maximal causal speed of the universe,* that includes the *interior* of stars, quasars and black holes, is expected as being much bigger than the speed of light in vacuum. As an illustration, the plot of experimental data on the structure of the neutron and the $p - \bar{p}$ fireball of the Bose-Einstein correlation yields the value $V_{max} = 1.653\ c$ [30d]. By recalling that black holes have a dramatically bigger density than that of the neutron or the $p - \bar{p}$ fireball, values much bigger than $V_{max} = 1.653\ c$ are expected in the universe.

To provide an initial but quantitative representation, by assuming n_s as the average of the three space characteristic quantities, the total energy of the universe is given by

$$E_{tot}^{univ} = m_{tot}^{univ} V_{max,aver}^2 \ \gg \ m_{tot}^{univ} \times c^2, \tag{45}$$

Consequently, the assumption of special relativity implies, on serious scientific grounds, the abstraction of the universe to a set of *massive points,* with consequential universality of the speed of light and insufficient energy to explain its dynamics. The assumption of the covering isorelativity allows an exact numerical representation of the needed energy, the excess originating from the maximal causal speed in the interior of astrophysical bodies being bigger than c, and we shall write

$$E_{darkenergy} = m_{tot}^{univ}\ (V_{max,aver}^2 - c^2). \tag{46}$$

The current estimate of the value of the dark energy can be used to provide an estimate of the average value of V_{max} for the universe. For instance, assuming at the limit that the missing energy is 100-times the Einsteinian value, we get the estimate

$$V_{max,aver} \approx 10\ c, \tag{47}$$

which is a rather reasonable value if one takes into account its limit character (100% excess energy), and the increasing number of black holes claimed to exist in the universe.

In short, rather than adapting the universe to verify a preferred theory belonging to the past century, *dark energy is a direct experimental evidence*

of the deviations of the universe from special relativity, with particular reference to deviations from the speed of light in vacuum as the maximal causal speed in favor of much bigger average values.

9. Additional astrophysical verifications.

Isorelativity for matter and its isodual for antimatter have numerous additional applications in astrophysics and cosmology. The strongest evidence of their validity is given by quasars that are physically connected to an associated galaxy while having dramatically different redshifts [68]. In fact, the use of special relativity would mandate corresponding dramatically different speeds as a result of which the quasars would have been separated from the galaxies billions of years ago.

Numerous interpretations of the above anomalous occurrence have been attempted, such as the hypothesis that the difference in cosmological redshift is due to *creation of matter* within the quasars [68]. However, none of these interpretations have achieved the necessary numerical representation, as well as identification of the origin of the continuous creation for scientific validity.

In 1991, Santilli [28b] proposed the simplest possible explanation according to which the indicated difference in cosmological redshifts is merely due to *the slow-down of the speed of light in the huge quasar chromospheres* (that can be as large as entire galaxies), similar to the slow-down of the speed of light in our atmosphere (Section 2). As a result, light exits the quasar chromospheres already isoredshifted, that is, redshifted without relative motion.

A similar occurrence does not exist in the same magnitudes for the associated galaxy because the intergalactic medium is dramatically less dense than that of the quasar chromosphere, although still existing in such a way to cause an isoredshift. In this way, light from physically connected quasars and galaxies can reach us with dramatically different redshifts even assuming that they are both at rest with respect to us. Needless to say, this at rest possibility is only a limit one because in reality a conventional redshift cannot be excluded, although much smaller than currently believed.

By using Isopostulate IV, Eq. (32) in approximation (33), Santilli [*loc. cit.*] suggested different isodoppler shift for the associates quasars and galax-

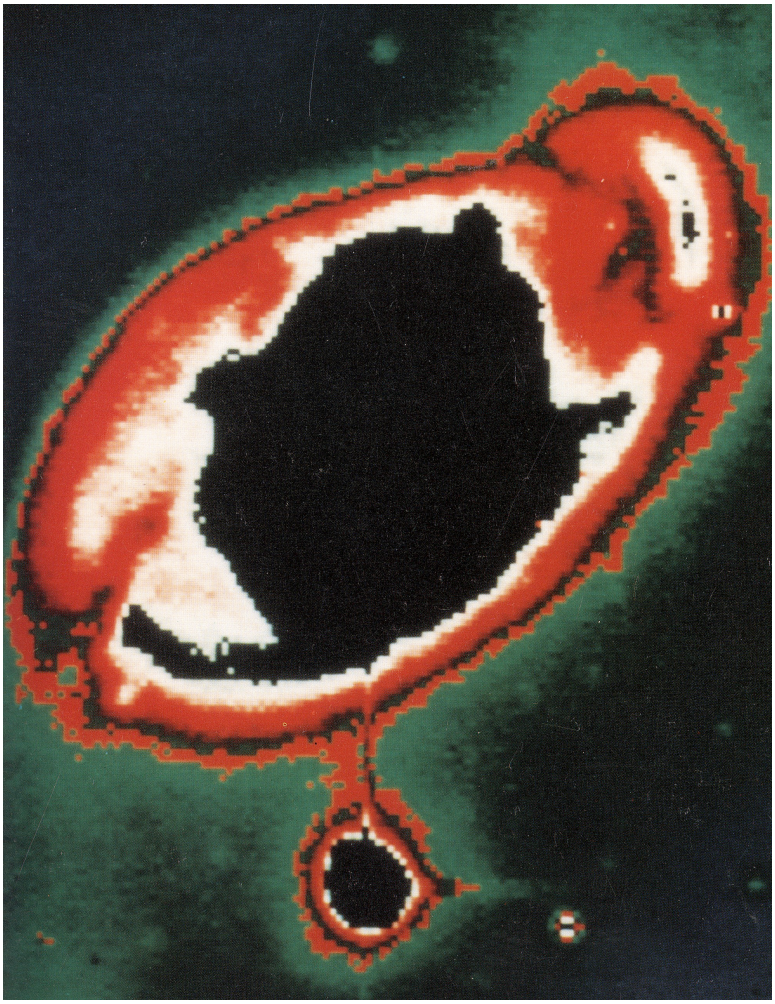

Figure 5: The experimentally verified [68] physical connection between the galaxy NGC (top) 4319 and the quasar Mark 205 (bottom), via the superposition of several gamma spectroscopic plates. By contrast, the quasar Mark 205 has a redshift with $z = 0.07$, while the associated galaxy NCG 4316 has a redshift of only $z = 0.0056$. The interpretation of this difference requires necessary departures from the special and general relativities, because such a large difference would require that the quasar has at least 104 times the speed of the galaxy, under which conditions the quasar and its associated galaxy would have separated completely billions of years ago. Santilli's isorelativity permits an exact, numerical, and invariant representation of the indicated large difference in cosmological redshifts, even at the limit of no relative motion with respect to Earth (picture from ref. [68]).

ies, where n_s is the space characteristic quantity in the direction of emission of light. As one can see, the above isolaw predicts an additional contribution in the redshift due to the anisotropy and inhomogeneity of quasar chromospheres.

GAL.	ω'_1	QUASAR	B	$\hat{\omega}_2$
NGC	0.018	UB1	31.91	0.91
		BSOI	20.25	1.46
NGC 470	0.009	68	87.98	1.88
		68D	67.21	1.53
NGC 1073	0.004	BSO1	198.94	1.94
		BSO2	109.98	0.60
		RSO	176.73	1.40
NGC 3842	0.020	QSO1	14.51	0.34
		QSO2	29.75	0.95
		QSO3	41.85	2.20
NGC 4319	0.0056	MARK205	12.14	0.07
NGC 3067	0.0049	3C232	82.17	0.53

Figure 6: A summary of Mignani's data [69] verifying Santilli's isorelativity [28] for all major quasars that are physically associates to galaxies according to clear spectroscopic or other evidence, while having dramatically different cosmological redshifts.

In 1992, R. Mignani [69] provided a direct experimental verification of Santilli's Isorelativity and related isodoppler law for all the most important pairs of quasars and associated galaxies. The verification was done via the parameter

$$B = \frac{n_4}{n_s} = \frac{(\delta\omega + 1)^2}{(\delta\omega + 1)^2 + 1} \times \frac{(\delta\hat{\omega} + 1)^2 - 1}{(\delta\hat{\omega} + 1)^2 + 1}, \tag{48}$$

where $\delta\omega$ represents the measured Einsteinian redshift for galaxies, and $\delta\hat{\omega}$ represents the isotopic redshift for quasars according to Santilli's law (33).

Yet another experimental verification of Santilli isorelativity is given

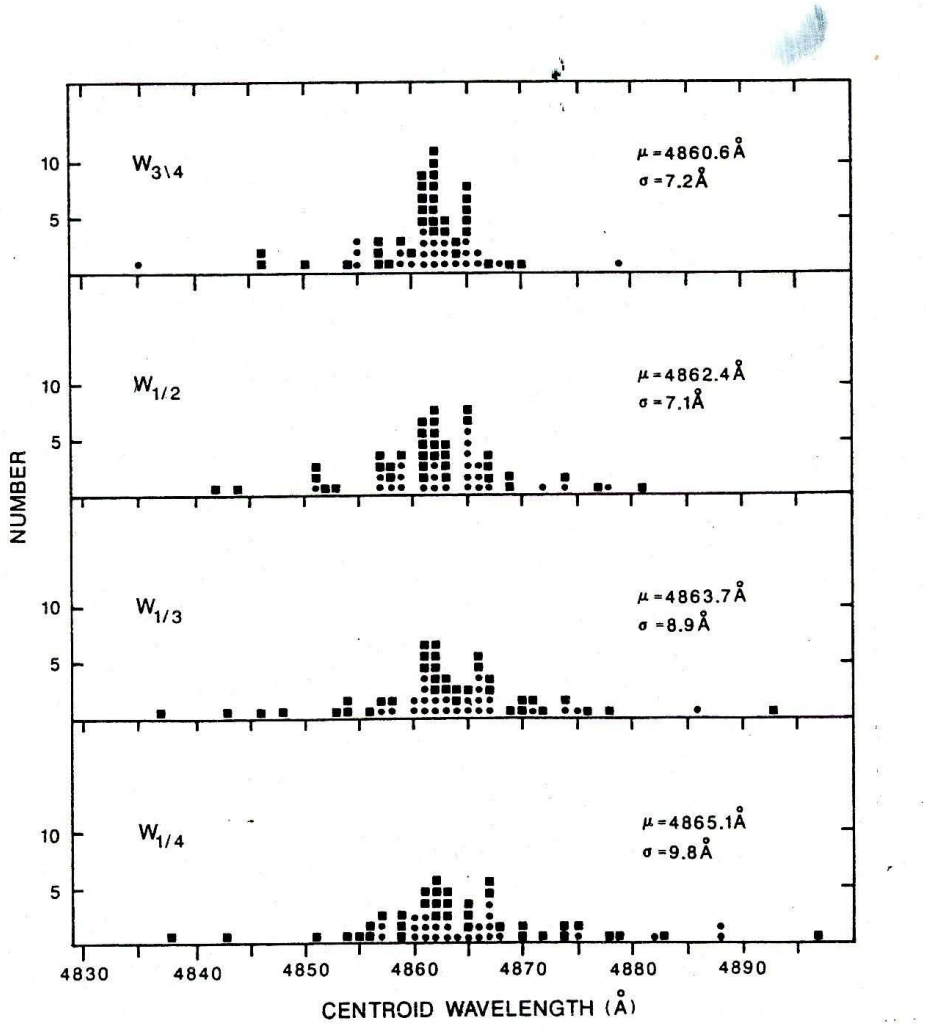

Figure 7: A schematic view of Sulentic's [70] discovery of the internal red- and blue-shift of quasars, that is, the decrease or increase of the cosmological redshift of quasars with corresponding variations of the light frequency. The latter occurrence is a further experimental confirmation of the validity of Santilli's iso-Minkowskian geometry for quantitative representations of cosmological data. In fact, the evidence establishes a dependence of the redshift with the frequency, which is evidence of propagation of light within physical media at the foundation of isorelativity.

by the exact, numerical, and invariant representation [71] of the *internal red-, and blue-shift of quasars.* We are here referring to the unexpected behavior whereby, for a given cosmological redshift, there can be relatively smaller shifts toward the red or toward the blue. This is a phenomenon that clearly confirmed Santilli's isorelativity because it is known since Newton times, that the index of refraction of light has an explicit dependence on the frequency, resulting in the beautiful separation of light into its various colors via a crystal. But the index of refraction is the characteristic quantity n_4. Hence, the quasars internal blueshifts and redshifts can be explained via a simple functional dependence of the characteristic quantities on the frequency, the simplest one being the linear dependence as in Eq. (12) (see Ref. [71] for details and fits).

Note the impossibility for special and general relativities to represent the astrophysical data of this subsection. Hence, the astrophysical data here considered provide direct experimental support to the covering isorelativity, including the absence of the expansion of the Universe and of dark matter or energy.

The ethically sound reader should be aware that, in view of the evident violation of Einsteinian theories by the data of Figure 5, the experimental astrophysicist Halton Arp (a former colleague of the author at Harvard University) experienced extreme academic obstructions still continuing to this day, and that all sort of attempts have been made by organized interests on Einsteinian doctrines to dismiss, discredit or just ignore the data here considered. Nevertheless, Arp has continued to confirm his experimental measurements and, in particular, his severe criticisms of the Big Bang conjecture that is directly dismissed by his data.

In the author's view, the case studied in this section constitutes an additional blatant evidence of the scientific obscurantism afflicting astrophysics and cosmology because, not only the validity of a given theory is set by political acceptance from a sufficient number of physicist at sufficiently reputable institutions, but the climax of the obscurantism manifests itself in the manipulation of *experimental* evidence to maintain the validity of Einsteinian doctrines under conditions they were not conceived for.

10. Proposed experiments.

Serious science can solely be conducted via experimental resolutions one way or another and, above all, by respecting their results until dismissed by clear counter-measurements, since the denial of experimental evidence via theoretical theologies or manipulated counter-experiments is a definition of scientific obscurantism.

The central assumption of Santilli isorelativity (and cosmology) is that physical media, whether made up of matter or light, cause an alteration (called mutation) of the fabric, and therefore of the geometry of Minkowski spacetime for the vacuum (empty space). A main consequence is that, when propagating within transparent physical media, light is predicted to experience an alteration (also called mutation) of its frequency, wavelength and speed.

Once the speed of light is no longer assumed as being a universal constant throughout all of the universe, but a local variable $C = c/n(x, v.f, ...)$ depending on the characteristics of the medium at hand, while being a constant $C = c, n = 1$,only in empty space, the interaction of light with the medium can be scientifically treated.

It then follows that light propagating within *physical media of low density* is predicted to lose energy $E = hf$ to the medium with consequential *isoredshift,* that is, a decrease of the frequency without any relative motion between the source, the medium and the detector. An *isoblueshift* is instead predicted for light propagating within *hyperdense physical media,* such as in the intgerior of gravitational collapse, due to the acquisition of energy $E = hf$ from the medium, with consequential increase of the frequency f without any relative motion.

By ignoring dust in first approximation, intergalactic space is a transparent physical medium of low density characterized by light. In fact, we can see the entire universe from any of its points. Consequently, an extremely large number of light beams originating from all directions in space passes through every point of intergalactic space. This implies that light from a far away galaxy must cross through light from the rest of the universe before reaching us, resulting in the prediction of isoredshift, in this case, a decrease of the frequency with comparatively ignorable relative motion between Earth and the galaxy. This prediction has been here submitted because it can be experimentally tested with existing technologies via the

following experiment based on passing light through light:

PROPOSED EXPERIMENT 10.1: Simulate intergalactic space in a thermally insulated vacuum tube of 10 *m in length and* 10 *cm in diameter with transparent terminal walls, the tube internally housing light sources with a radial emission of light then absorbed by suitable radially placed internal receptacles to prevent dispersal; propagate a monochromatic laser light of known frequency along the axial symmetry of the tube; and measure at the end of the propagation the possible isoredshift of the laser light, as well as the possible increase of temperature over a sufficiently long period of time.*

Note that, in the event the isoredshift is not directly measurable for a given travel of light within a given simulation of intergalactic space, the detection of the increased temperature over a sufficiently long period of time would equally confirm the isoredshift because such an increase of temperature can be solely interpreted via a loss of energy $E = hf$ by light to the medium that, in turn, can solely occur under a decreased frequency f. Note the strict absence of any relative motion, except that of light, as a necessary condition to test the main hypothesis of the isoredshift, that without any (comparatively appreciable) relative motion.

In addition to the above, isoredshift can be tested via the following experiment of quite simple realization and moderate cost:

PROPOSED EXPERIMENT 10.2: Propagate a monochromatic laser light through the axial symmetry of a thermally insulated tube with 10 *m lenght and* 10 *cm diameter with transparent terminal walls, the tube being filled up with a filtered transparent fluid, such as air or another gas at* 330 *bars or water at atmospheric pressure, and measure the expected isoredshift at the end the propagation as well as the expected increase of the medium temperature over a sufficiently long period of time.*

Note the lack of impact on the proposed experiment of possible Compton scattering of light within the fluid molecule because the scattered light will not exit a sufficiently long tube under any significant scattering. In any case, the scattering would blurry the source. Alternatively, the loss of intensity of the laser light is irrelevant, since the measurement is for its frequency.

Note also that for short distance, light does not change color during its propagation in water, in which case the decrease of the light speed is due to the decrease of the wavelength, an occurrence independent from the isoredshift here considered.

The case for sufficiently long propagation of light in water is unknown. Therefore, the filling up of the tube of Proposed Experiment 10.2 with pure water is indeed recommended, for which reason the word "fluid" was used. However, in the event no isoredshift in water is measured, the results should not be used to claim "isocosmology is invalid" because intergalactic space is not filled up with water.

An additional experimental resolution was proposed in Ref. [28b] of 1991, and can be formulated as follows:

PROPOSED EXPERIMENT 10.3: Monitor the frequencies of selected spectral lines of the Sun light in the transition from the Zenith to Sunset and from Sunrise to the Zenith to detect the presence or absence of an anomalous isodoppler shift in addition to the conventional Doppler shift.

In essence, the tendency of Sun light toward the red at Sunset can be a visible evidence of the isodoppler redshift of this paper because it is very close to the tendency toward the red at Sunrise. An observer on Earth moves *away* from (*toward* the) Sun at Sunset (Sunrise) at the speed of about $1,200 km/h$ that can cause a conventional Doppler's *redshift* (*blueshift*) measurable with existing technologies. The opposing nature of the Sunset redshift vs the Sunrise blueshift compared to the dominance of redshift in both cases suggests the presence of an anomalous contribution, thus requiring an experimental resolution one way or the other as a condition to conduct serious science.

Said anomalous contribution is dismissed by organized interests on Einsteinian doctrines, for which reason Experiment 10.3 has been discredited or ignored since 1991 despite its suggestion to numerous astrophysical laboratories. The dismissal is based on the old "argument" reviewed in Section 2, that light can be reduced to photons scattering in Earth's atmosphere resulting in the release of a dominant red light.

Studies conducted in Refs. [28-31] have shown that the above "argument" has no scientific foundations for various reasons, such as:

1) The scattering of light blurries the source, as well known. Hence, had the "argument" been correct, we should not see the Sun at Sunset or Sunrise, while light directly originating from the Sun is itself red.

2) When the Sun is at the Zenith, the entire atmosphere, including the atmosphere toward the Sunset and Sunrise, is blue, thus dismissing as nonscientific the indicated "argument" because it qould require that at least the atmosphere toward the horizon should be predominantly red.

3) Specific calculations have shown that the scattering of light in our atmosphere is basically unable to explain *numerically* the dramatic shift from the predominance of blue at the Zenith to the predominance of red at the horizon. In the absence of such a numerical interpretation, the indicated "argument" is then a mere theology.

4) The "argument" can be easily dismissed on grounds that electromagnetic waves with large wavelength cannot be effectively reduced to photons, yet such waves can be used in Experiment 10.1.

5) Experimental evidence of the anomalous isoredshift is already available from the change of the pitch of radio waves of spaceships when traveling in the back of planetary atmospheres, such as that of Jupiter or Mars.

Note that the successful conduction of Experiment 10.1 would: 1) Terminate theological arguments supporting the universal validity of Einstein special relatoviity throughout the universe; 2) Confirm the validity of santilli isorelativity in its most fundamental; feature, the alteration of spacetine by physical media; and 3) Eliminate the expansion of the universe, dark matter and dark energy, as well as confirms Arp's astrophysical measurements.

Numerous, additional, *resolutory* experimental verifications or dismissals are possible, not only in astrophysics, but also in particle physics, nuclear physics and superconductivity (see Refs. [28b,29b,30d] for details), but again, to prevent the illusion of a resolution one way or another, the experiments have to be seeded in an ethically sound scientific environment.

11. Comparison with "Tired Light"

As it is well known (see, e.g., Ref. [12] and papers quoted therein) numerous authors have proposed several different models with cosmological redshift without relative motion betwen Earth and far away galaxies. For instance, F. Zwicky proposed in 1929 a cosmology, known as the Tired Light

Cosmology, in which the universe had no expansion, and the redshift was interpreted via a loss of energy, hence of frequency, by light over time due to scattering with atoms along its trajectory. Zwicky's view was adopted in 1935 by various astrophysicists, most notably by the initiator of theories on the expanding universe, E. Hubble, who wrote *if the red-shift is not due to recessional motion, its explanation will probably involve some quite new physical principles*. A variety of mechanisms were studied to appraise the hypothesis of the "Tired Light", including Compton scattering, gravitational interactions, electromagnetic interactions, and other possible sources. Following these and other initial developments, the Tired Light Cosmology was abandoned because of apparent inconsistencies identified below.

The primary differences between our Isocosmology and the Tired Light Cosmology are the following.

MATHEMATICAL DIFFERENCES. The preceding models treat light at speed different than c with the mathematics of special relativity (conventional numbers, spaces, algebras, symmetries, etc.). It is known nowadays that these studies verify the *Theorems of Catastrophic Inconsistencies of Noncanonical or Nonunitary Theories* [19-27] due to the necessary noncanonical character of deviations from the speed of light in vacuum (i.e., of maps of the type $\eta = (1, 1, 1, -c^2) \ \rightarrow \ \hat{\eta} = (1, 1, 1, -c^2/n^2)$. From the very definition of "noncanonical transforms" (i.e., transforms that do not preserve the unit), these inconsistencies include: the lack of preservation over time of the basic units of measurements; the lack of prediction of the same numerical values under the same conditions at different times; the admission of events violating causality; and others. The sole mathematics known at this writing resolving said Theorems of Catastrophic Inconsistencies, including the achievement of the crucial invariant over time, is Santilli's isomathematics [41] at the foundation of isorelativity (isonumbers, isospaces, isoalgebras, isosymmetries, etc.).

PHYSICAL DIFFERENCES. The Tired Light and similar models have been based to date on the assumption that the speed of light is changed, but spacetime remains Minkowskian, thus leading to additional inconsistencies, this time, of physical character. In fact, by maintaining the conventional spacetime, the sole applicable relativity is the special one, with evident con-

tradictions that resulted to be unsolvable. Hence, the fundamental physical difference between these studies and the cosmological model proposed in this paper is that the latter is based on the structural mutation of spacetime because evidently necessary for any alteration of the speed of light. In turn, the mutation of spacetime sets the foundations for Santilli's covering isorelativity that eliminates said incompatibilities *ab initio,* the latter being conceived and tested for locally varying speeds of light.

EXPERIMENTAL DIFFERENCES. The most important differences between the studies on Tired Light and the isocosmology of this paper are of experimental character, because the possible explanations of the former have not resulted to be experimentally testable on Earth, while the latter can indeed be resolved with technologically feasible experiments on Earth.

Besides the above, in the author's view, the most important difference between pre-existing models eliminating the expansion of the universe and the isocosmology of this paper is that *the Minkowski-Santilli isogeometrization of physical media allows the achievement of a covering law for the redshift without motion that is directly universal in the sense of including as particular cases all other possible laws, directly in the frame of the experiment, thus without coordinate transformations.* In fact other laws can be obtained from isorelativity laws via different expansions in terms of different parameters subjected to different truncations, as known to experts in the field, e.g., for the case of deviations from the Einsteinian time dilation ;laws in the decay of unstable particles at high energies.

Possible remaining objections can be readily solved with isorelativity. For instance, the redshift is indeed the same for all wavelengths because solely dealing with a decrease of the frequency (energy); light from far away galaxies is not blurred precisely because of the absence of Compton scattering; the model produces a clear interpretation of the cosmic background radiation because the energy is lost by light to space, rather than to matter, in which case the lost energy must be released in the sole possible form, via radiations. Additional minor, but technically more involved objections, will be dismissed in subsequent more technical treatments.

12. Iso-, geno- and hyper-cosmology

All astrophysical aspects studied in this paper are part of a new series of cosmologies with progressively increasing complexities for the representation of progressively broader events in the universe. The first and simplest one is known under the name of *Santilli's isocosmology,* and can be reduced to the following three primitive isoprinciple:

ISOPRINCIPLE I: All events in the universe verify a universal isosymmetry given by the Kronecker product of the Lorentz-Poincaré-Santilli isosymmetry for matter and its isodual for antimatter,

$$\hat{S}_{univ} = [\hat{SO}(3.1) \times \hat{T}(3.1) \times \hat{I}(1)] \times \hat{SO}^{d}(3.1) \times \hat{T}^{d}(3.1) \times \hat{I}^{d}(1), \quad (49)$$

Note that we are referring to the only known cosmology based on a universal symmetry including gravitation, at both the classical and operator levels, the latter one permitted by *hadronic mechanics* [28-31]. Note also that all results of this paper for matter and, independently, for antimatter, can be uniquely derived from the above isosymmetry.

ISOPRINCIPLE II: At the limit of equal amount of matter and antimatter, the universe has all null total characteristics, that is, null total time, null total energy, null total linear momentum, etc.

Note that this additional feature (that is a consequence of the isodual theory of antimatter [31], see also Section 6) is solely possessed by isocosmology and is intended to avoid discontinuity at creation, evidently because the total characteristics would be null prior to creation and remain so thereafter.

Note that the presence of antimatter in the universe renders meaningless the words "age of the universe" [31]. To illustrate the complexities of the universe, even the simplistic words "age of the matter component of the universe" may turn out to be illusory due to the lack of knowledge of the average time isounit for the universe. In any case, studies in isotopies have established that our view of a given object via light, by no means, implies that the object evolves with our time since it could be in a dramatically different past, present or future time (see the *isobox* of ref. [30d]).

ISOPRINCIPLE III: The initiation of stars in the universe requires con-

tinuous creation.

Stars initiate their lives as being solely composed of hydrogen. The first synthesis is that of the neutron from protons and electrons, after which we have the synthesis of deuteron, helium, etc. However, the neutron is 0.782 MeV *heavier* than the sum of the rest energies of the proton and the electron. In the event this missing energy is provided by the environment, stars could not initiate to produce light because, at their initiation, stars would *require* (rather than release) the energy of $10^5 0$ MeV/sec or more. The sole plausible explanation is that the energy missing for the synthesis of the neutron originates from the *ether* as a universal substratum characterized by the superposition of positive and negative energies (for brevity, see review [78] and vast literature quoted therein).

In closing, the author has no word to stress that isocosmology is merely a limit formulation requiring numerous broadening for a more adeguate representation of the universe. For instance, the universe may indeed contain antimatter as suggested by numerous evidence, such as: light flashes seen by astronauts in the upper dark side of our atmosphere expected to be due to the annihilation of antimatter cosmic rays; the 1908 Tunguska explosion in Siberia that can be solely explained quantitatively via the annihilation of an antimatter asteroid due to lack of a crater, the immensity of the devastation and additional facts; and other events. However, the limit case of an exactly equal amount of matter and antimatter in the universe remains debatable. Note, again, the initiation of *antimatter astrophysics* that has been absent in the 20th century.

Additionally, isocosmology is unable to represent thermodynamical laws, due to the reversibility over time of its mathematical and physical structure. The latter insufficiency is resolved by *Santilli's genocosmology* based on Lie-admissible covering of Lie-isotopic formulations [27] we cannot possibly review here. We merely indicated that the genotopic covering of isotopic theories is based on structurally irreversible classical and operator mechanics that have permitted indeed the first direct representation of thermodynamical laws. Hence, genocosmology is the first and only representation of the universe known to the author achieving compatibility with thermodynamical laws.

Finally, the Greek meaning of the word "cosmos" indicates the inclusion

of everything. Hence, the author firmly believes that no theory can be truly called a "cosmology" without the inclusion of *biological structures* for which, not only special relativity, but also its coverings iso- and geno-relativities are grossly insufficient due to difficulties beyond our imagination, such as the creation of a large and extremely complex organism from a DNA.

To initiate the study of the latter aspects, the author has proposed the yet broader *hypermathematics* that allows the representation of the universe as being irreversible over time, and $(3 + 1)$-dimensional, but *multi-valued,* the first hyperstructure of the class here considered being given by the ether as the two-valued superposition of positive and negative energy permitted by different spacetimes (see Ref. [30d] for brevity).

Hypercosmology is the broadest possible cosmology known to the author permitting experimental verifications via measurements because based on *Santilli hypernumbers* [30a[that do verify the axioms of a field. Nevertheless, despite its vast representational capabilities, that do include the preceding cosmologies as well as quantitative representations of biological events, by no mean, the author considers hypercosmology the final description, because the complexities of the universe are simply beyond our most vivid imagination, and so much remains to be discovered by young minds of any age not subservient to ascientific and asocial organized interests on preexisting doctrines.

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