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MATHEMATICAL FORMULATION, PHYSICAL INTERPRETATION AND EXPERIMENTAL VERIFICATION OF ISORELATIVITY FOR INTERIOR DYNAMICAL PROBLEMS

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Abstract

We review the 20th century formulation of special relativity and its conditions of exact validity (**exterior dynamical problems** of point particle and electromagnetic waves propagating in vacuum); we review the various evidence on the inapplicability (rather than violation) of said formulation of special relativity for broader physical conditions and select for study in this work the time reversal invariant subclass of **interior dynamical problems** of extended particles and electromagnetic waves propagating within physical media; we review and upgrade the author's long and solitary journey to achieve maturity of treatment of interior problems; we review and upgrade the covering Minkowski-Santilli isospace and its universal Lorentz-Poincaré-Santilli isosymmetry; we review and upgrade the mathematical formulation of the covering isorelativity; we review and upgrade the physical interpretation of isorelativity with particular reference to the causal time invariant treatment of extended particles and electromagnetic waves propagating within physical media at subluminal as well as superluminal speeds; we finally review and upgrade the experimental verifications of isorelativity for interior problems in classical mechanics, particle physics, nuclear physics, superconductivity, chemistry, astrophysics and cosmology. The isodual treatment for interior problems of antimatter is briefly outlined for completeness.

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1. Foreword.

Contemporary physics has already seen a number of developments "beyond" the conception of special relativity by Lorentz[1], Poincaré[2] and Einstein[3], herein referred to as the LPE special relativity, or SR for short), in the sense that the new advances require the surpassing of LPE theories via suitable covering formulations, of course, for conditions broader than those of their original conception and experimental verification, with particular reference.

In particular, we herein accept as exactly valid SR and its underlying formulations for the so-called **exterior dynamical problems,** consisting of point like particles and electromagnetic waves propagating in vacuum. The covering of SR and underlying formulations presented in this work solely refer to **interior dynamical problems** consisting of extended particles and electromagnetic waves propagating within physical media at speeds bigger or smaller than that of light in vacuum hereon referred to as **superluminal or subluminal speeds,** respectively.

Among a variety of new advances beyond SR reviewed in this work, we point out:

1) The discovery since the early 1980s that the constituents hadrons at large, and of the neutron in particular (here referred to as extended wavepackets propagating within a hyperdense medium) must travel at superluminal speed as a condition to achieve a numerical representation of *all* characteristics of hadrons (rather than the mass alone) [56-64].

2) The pioneering discovery by Guenter Nimtz and its associates in the early 1990's of the propagation of electromagnetic waves within certain guides (rather than in vacuum) at superluminal speeds [65-70];

3) The confirmation of the preceding superluminal speeds by the CERN / GRAN SASSO laboratories via the measurement of neutrinos propagating at superluminal speeds underground (rather than in vacuum in which case objections have been correctly raised, although basically inapplicable underground);

4) Santilli's measurements in 2009, independently confirmed in 2011, of deviations from the Doppler's frequency shift for light propagating in our atmosphere (rather than in vacuum);

5) The recent discovery by Alexander Kholmetskii and his group of deviations from special relativity for rotating reference frames (rather than for the usual inertial reference frames); and other advances over 20th century knowledge.

The above experimental discoveries have stimulated a variety of comments ranging from great enthusiasm for true basic advances, to personal criticisms of the founders of SR, with statements such as "Einstein was wrong", "violation of special relativity", and the like.

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[1] L. V. Lorentz, Philos. Mag. 34, 287 (1867)

[2] H. Poincaré, Archives nerland. des Sciences exactes et naturelles, 2, vol. 5, 252-278 (1900) http://www.santilli- foundation.org/docs/Poincare- 1900.pdf

[3] A. Einstein, Ann. Phys. (Leipzig) 17, 891 (1905) http://www.fourmilab.ch/etexts/einstein/specrel/www/

Following some fifty years of research in the field (see the recent general review by J. V. Kadeisvili and I. Gandzha [100]), a main objective of this work is to defend the memory of Lorentz, Poincaré and Einstein by showing that, *under the proper physical conditions and mathematical treatment, superluminal and subluminal speeds are indeed compatible with the abstract axioms of SR and, consequently, no "violation" can be scientifically claimed.*

Alternatively, a main scope of this paper is to indicated that, *rather than abusing the name of Albert Einstein by applying his theories under conditions never intended for, never verified and actually disproved by experiments, the best way to honor Einstein's name is to broaden the applicability of his axioms, of course, for conditions unthinkable during Einstein's times and under the appropriate mathematical treatment.*

The reader should be made aware up front that, as we shall see, the achievement of the above objectives has required the isotopies (that is, axiom-preserving liftings) of the entire 20th century mathematics underlying SR, the isotopies of the entire body of physical formulations characterized by SR, as well as the development of new technologies for the very detection of deviations from 20th century formulations.

It is evident that such a body of advances cannot possibly be reviewed in this work that, consequently, is merely an introduction to the new 21st century sciences in a language accessible to the general physics audience. For any serious knowledge of the mathematical, theoretical and experimental treatments presented in this work, interested scholars are suggested to study the quoted specialized literature all available in free pdf download.

2. Applicability Conditions of the 20th Century Formulation of Special Relativity.

The author has often stated in his writings that *special relativity has a majestic axiomatic structure and an impressive body of experimental verifications for the conditions of its conception and applicability.* The axiomatic foundations of SR are provided by the *Minkowski spacetime* $M(x, \eta, I)$ with familiar line realization[4]

$$x = (x_\mu) = (x^1, x^2, x^3, t), \;\; \eta = Diag.(1, 1, 1, -c^2), \;\; I = Diag.(1, 1, 1, 1), \tag{2.1}$$

the historical line element

$$x^2 = x^\mu m_{\mu\nu} x^\nu = x_1^2 + x_2^2 + x_3^2 - t^1 c^2; \tag{2.2}$$

and its celebrated symmetry, hereon referredto as the *Lorentz-Poincaré (LP) symmetry,* where the x's are restricted hereon to be the spacetime coordinates of the observer (thus prohibiting any use of coordinate transformations to hypothetical reference frames), η is the familiar *Minkowski metric,* and $I = Diam(1, 1, 1, 1)$ is the basic unit of the LP symmetry.

[4]The literature on SR is so vast to discourage any discriminatory selection.

For the particular case of transformations in $(3,4)$-dimensions, the sole considered for simplicity, we have the historical *Lorentz transformations* at the ultimate foundations of SR., here formulated for $x_4 = tc$ and $\eta = Diag.(1,1,1,-1)$

$$x^{1'} = x^1, \;\; x^{2'} = x^2 \tag{2.3a}$$

$$x^{3'} = \gamma(x^3 - \beta x^4) \tag{2.3b}$$

$$x^{4'} = \gamma(x^4 - \beta x^3) \tag{4.3c}$$

where

$$\beta = v/c, \;\; \gamma = 1/\sqrt{1-\beta^2}. \tag{2.4}$$

plus the remaining components of the LP symmetry, such as rotations, translations, discrete symmetries, spinorial covering etc. hereon assumed as known.

The first reason for the "majestic axiomatic structure" of SR is that the above formulations are sufficient to characterize in a unique and unambiguous way the celebrated SR axioms, namely

AXIOM 2.I: The maximal causal speed is that of the speed of light in vacuum e.g.,

$$V_{max} = c; \tag{2.5}$$

AXIOM 2.II: The addition of speeds follows the relativistic law

$$V_{tot} = \frac{v_1 + v_2}{1 + \frac{v_1 v_2}{c^2}}; \tag{2.6}$$

AXIOM 2.III: The dilation of time, the contraction of lengths and the variation of mass with speed follow the relativistic laws

$$t' = \gamma t, \tag{2.7a}$$

$$\ell' = \gamma^{-1\ell}, \tag{2.7b}$$

$$m' = \gamma m; \tag{2.7c}$$

AXIOM 2.IV: The frequency shift of light follows the Doppler's law

$$\omega' = \omega/[1 \pm \beta \, cos(\alpha)]; \tag{2.8}$$

AXIOM 2.V: The mass-energy equivalence follows the Poincaré-Einstein law[5]

$$E = mc^2. \tag{2.9}$$

[5]It is well known to serious scholars (to qualify as such) that the equivalence principle was first conceived by Henri Poincaré in the paper quoted in footnote[2] and expressed in the form $m = E/c^2$ for the representation of the impulse of electromagnetic waves and other aspects. Einstein then wrote the equivalence law in the form $E = mc^2$ and extended it to the mass in his 1905 paper quoted in footnote[3]. It is also known from the historical archives that Einstein exchanged various letters in the topic with Poincaré, but abstained from quoting the exchanges in his 1905 paper. This original posture by Einstein was then adopted by all Einstein followers, by reaching in this way the current, widespread, political dubbing of "Einstein's equivalence principle." A most authoritative historical account on the birth of the Lorentz-Poincaré-Einstein special relativity beyond organized political adulterations is that by A. A. Logunov, *Henri Poincaré and Relativity Theory,* Moscow Nauka (2005).

Another reason for the "majestic axiomatic structure" of SR is the preservation of the above axioms over time, that is, the prediction of the same numerical values under the same conditions at different times, a feature truly crucial for physical consistency hereon referred to as *time invariance.* As it is well known, this basic feature is due to the fundamental LP symmetry.[6]

Yet another reason for the "majestic axiomatic structure" is that SR has a canonical structure or, more specifically, *the LP transformations constitute canonical transformations on Minkowski spacetime over the field of real numbers.* As such, by definition, the LP transformations leave invariant the basic unit $I = Diag.(1, 1, 1, 1)$ of the theory. This seemingly trivial feature allows SR to preserve over time the assumed basic units because said unit is the abstract, realization-free version of the units actually used in measurements, such as $I = Diag.(1\ cm, 1\ cm, 1\ cm, 1\ sec)$.

The operator image of SR, *relativistic quantum mechanics* (RQM),then has a *unitary structure,* namely, *the operator version of the LP symmetry characterizes unitary transformations on a Hilbert space over the field of complex numbers.* This additional seemingly trivial feature has further implications crucial for physical consistency, such as the preservation of Hermiticity, thus of observability, at all times and other implications.

In about one century since its inception, an impressive body of experimental verifications has been accumulated for SR and, since they are so well known, they do not need to be recalled here. However, a scrutiny reveals that all serious experimental verifications have occurred within the conditions originally stated by Einstein (rather than by Einstein's followers), namely, SR holds:

CONDITION 2.I: For point-like particles and electromagnetic waves;

CONDITION 2.II: When referred to inertial reference systems;

CONDITION 2.III: While propagating in empty space;

The words "serious experimental verifications" are referred hereon to direct measurements based on unadulterated axioms without *ad hoc* hypothetical abstractions, far fetched and unverifiable conjectures, arbitrary functions fitted from the data, and the like, under which adulterations any theory whatsoever can be claimed as being exact to the evident sole peril of its mentor.

3. Inapplicability Conditions of the 20th Century Formulation of Special Relativity.

In view of its historical successes, with the passing of time SR has been assumed by Ein-

[6]As equally well known, but generally not admitted, the crucial time invariance is lost in Einstein general relativity evidently because of the loss of a universal symmetry for the Riemannian line elements in favor of a "covariance" that, by definition, does not conserve numerical predictions. For this and numerous other structural insufficiencies, we refer interested readers to the post http://www.santilli-foundation.org/inconsistencies-gravitation.php and references quoted therein.

stein followers the world over as being valid under whatever conditions exist in the universe, expectedly, until the end of time. This posture has essentially turned a beautiful physical achievement of the human mind into a political setting, because it is known by serious scholars that *science will never admit "terminal" theories* and, no matter how beautiful a theory may appear to some, its structural generalization is only a question of time.

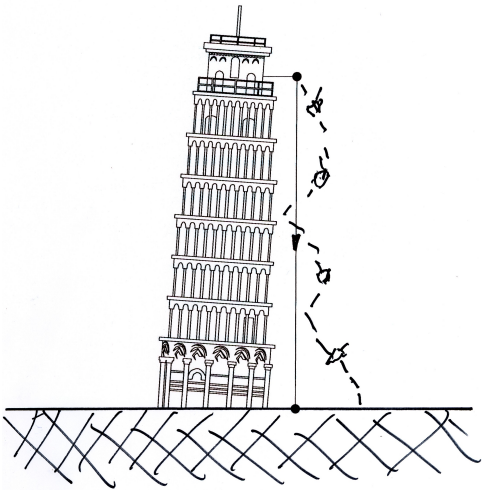

Figure 1: *A conceptual illustration of the main objective of Galileo relativity, the study of the motion of bodies in vacuum, here illustrated by the free fall of a ball from the Pisa tower by ignoring the resistance due to air, and the main objective of the nonrelativistic studies outlined in this work, illustrated by the free fall of a leaf from the Pisa tower with the inclusion of the resistance due to air.*

Besides the need for a serious, thus unbiased, scientific analysis, the need to inspect and appraise the limits of applicability of SR has emerged quite strongly in recent decades from the compelling need by mankind for basically new, environmentally acceptable energies.

In fact, all energies that could be conceived via Einstein's theories were fully identified by the middle of the 20th century and they all resulted in being environmentally unacceptable either because of excessive pollution in their production, or because of excessive radiations in their use or for other reasons.

Additionally, it was discovered in the late part of the 20th century that the imposition of SR under conditions it was never intended for and never directly verified, precludes the laborious scientific process of conception, formulation, test and industrial development of much needed new clean energies.

These and numerous other scientific, epistemological, financial, ethical, legal and other reasons have established the clear distinction between the *conditions of exact validity of SR,* Conditions 2-I to 2.III above, and the *conditions of its inapplicability,* where we would like to stress the word "inapplicability" because the theory was not intended by Einstein

for said conditions, thus qualifying as non-scientific the use of the word "violation."

Fifty years of research by this author (see general review by J. V. Kadeisvili and I. Gandzha, Ref. [100]), as well as by numerous colleagues around the world (we shall properly quote later on), have established that *SR is inapplicable under "any" departure from Conditions 2.I,. 2.II and 2.III,* according to the following outline:

INAPPLICABILITY 3.I: SR is inapplicable for extended particles in vacuum. This is the case for numerous reasons, the first being the fact that, on one side, SR has been strictly formulated along Newton's and Galileo's conception of point-like particles while, in the other side, particles are extended in the physical reality, as well as generally non-spherical and their representation would imply the breaking of the pillar of the LP symmetry, the rotational symmetry. Additionally, extended particles are deformable, and the incompatibility of SR with the deformation theory is well known. Above all, the inapplicability here considered is forcefully set by the mathematical foundations of SR, namely, its *local-differential topology,* that can only represent a finite number of isolated points. In summary, no representation of extended particles should be dreamed of under the 20th century formulation of SR without a structural revision beginning from its mathematical foundations of the theory.

Figure 2: *A more accurate illustration of the classical objective of the studies reviewed in this work, the structure of Jupiter as isolated from the rest of the universe, thus verifying the ten total Galilean conservation laws, yet its internal dynamics shows vortices with varying angular momenta as well as other effects beyond any hope of quantitative treatment via Galileo's relativity, thus requiring the construction of a suitable covering relativity [1b,4b].*

INAPPLICABILITY 3.II: SR is inapplicable for longitudinal waves in vacuum . As it is well known, SR is based on Maxwell's equations that solely admit electromag-

netic waves of *transverse* character, namely, such that the oscillation is perpendicular to the direction of propagation. A number of attempts have been made to extend Maxwell's equations in such a way to admit longitudinal waves (that is, waves in which the oscillations occur in the direction of propagation), although none of these attempts have resisted the test of time for various reasons, e.g., because longitudinal waves are predicted as being superluminal, thus in violation of Axiom 2.I. As we shall see, a central open problem of 21st century physics is the study of longitudinal waves propagating through the ether as a universal substratum because they emerge quite forcefully in the synthesis of the neutron from a hydrogen atom inside a star.

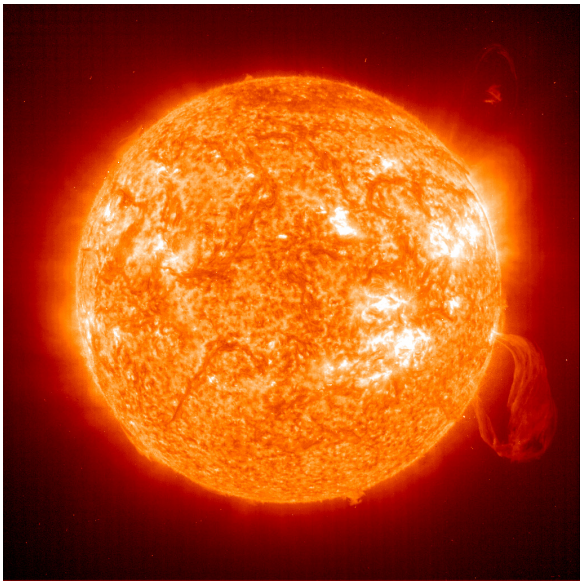

Figure 3: *An illustration of the operator objective of study, a quantitative representation of the Sun as a closed-isolated system, thus verifying the ten total conservation laws of non-relativistic and relativistic quantum mechanics, yet its treatment of interior processes via the notoriously linear, local and Hamiltonian theory of operator on a Hilbert space is excessive approximate. This is due to the complexity of interior processes within a hyperdense medium that requires a suitable nonlinear, nonlocal and non-Hamiltonian covering of relativistic quantum mechanics that has been built under the name of Hadronic Mechanics (HM) we shall briefly outline in tyhis work.*

3: **INAPPLICABILITY 3.III: SR is inapplicable for reference frames accelerating along a straight line.** The widespread claim of the "universal constancy of the speed of light" should be denounced as non-scientific when proffered as such by experts because the constancy of the speed of light has been experimentally verified, and can be claimed as a scientific reality, only under a number of conditions. That under consideration here is a departure from Condition 2.II, namely, that the speed of light is measured with respect to "inertial" reference frames (that is, frames moving with constant velocity). An instructive exercise for serious graduate schools in physics (that unfortunately,

is not generally proposed) is the proof that *the speed of light is no longer constant for reference frames moving along a straight line with different accelerations,* with consequential inapplicability of the entire theory. Orthodox readers are suggested to avoid the usual transition to general relativity, since accelerations are along a straight line, thus without any curvature and consequently, without any credible treatment with the Riemannian geometry.

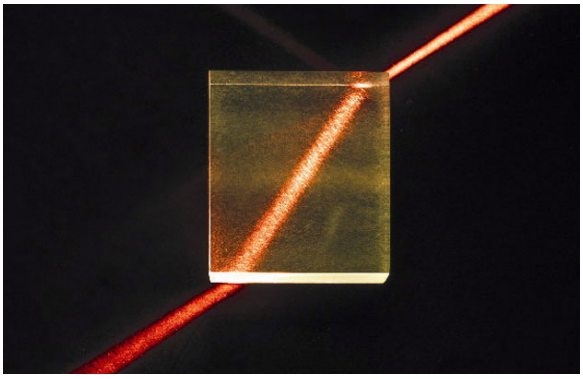

Figure 4: *Albert Einstein discovered that "certain frequencies" of light are "absorbed" by a given medium in a quantized way he called photons. Following this success, the "propagation" of "all" electromagnetic waves in a transparent medium, such as water, is widely reduced to photons scattering among the water molecules for the evident intent of bypassing a number of deviations from special relativity, and maintaining in this way the validity of Einstein's theories within water. This is a case of scientific obscurantism because, on one side, the reduction of light to photons does not allow a quantitative representation of visual evidence (such as the angle of refraction,* 30% *reduction of speed, etc. as shown in the text and quoted references) while, on the other side, quantitative, time invariant representations of all data for the propagation of all electromagnetic waves in water are widely dismissed if not discredited even when published in refereed journals. In this memoir we hope to initiate a scientific renaissance with covering views in the field based on numerical representation of evidence and direct experimental verifications.*

INAPPLICABILITY 3.IV: SR is inapplicable for rotating systems. This is an additional case of evident inapplicability because SR solely applies in the absence of accelerations, and in this case too, the transition to general relativity has no scientific content due to the impossibility of even formulating the representation of a rotating disc with the Riemannian geometry in a way minimally verifying physical laws, such as invariance over time. In any case, we shall review later on in this paper the experimental verification by A. Kholmetskii and his group of deviations from SR for rotating systems. Serious scholars know we are referring here to a serious limitation of SR, because the general motion of a physical, thus extended particle in empty space is a superposition of intrinsic (rather than orbital) rotations or extended (rather than point-like) particles and translations. Such a general motion is not represented by SR due to the sole representation of

orbital and translational motions for point-particles.

INAPPLICABILITY 3.V: SR is inapplicable within physical media. This is the case for a truly large number of reasons well known to serious scholars, among which we mention:

1) The inability to formulate SR within physical media due to the absence of inertial reference frames caused by resistive forces;

2) The violation of causality under SR axioms since particles can travel within physical media faster than the local speed of light (see, e.g., the Cerenkov light for the case of electrons propagating in water, cosmic radiations penetrating in our atmosphere at speeds bigger than that of local electromagnetic waves, and other cases);

3) The violation of the relativistic sum of velocities when the speed of light in $vacuum$ is assumed as the maximal causal speed within $physical\ media$ in the dream of avoiding the preceding violation of causality, since in this case the sum of two local speeds of light does not yield the local speed of light;

4) The impossibility of reducing physical, thus extended particles to point-like abstractions due to the loss in this case of resistive forces and the consequential abandonment of physical reality;

5) The dynamics of extended particles within physical media is characterized by contact, zero-range, nonlinear, nonlocal and nonpotential interactions that are beyond any dream of analytic representation by SR;

6) The inconsistency of the reduction of macroscopic systems to elementary point-like constituents established by the $No\ Reduction\ Theorems$ (e.g., the evident impossibility for a consistent reduction of a classical nonconservative, thus non-Hamiltonian system to an ideal set of elementary particles all in nice Hamiltonian conditions as necessary to recover SR, etc.);

7) The impossibility of reducing to photons all electromagnetic waves when $propagating$ within a physical medium due to the collapse of quantitative representations of data, such as the impossibility of representing numerical via a beam of photons the angle of refraction, the actual speed of electromagnetic waves within physical media,the propagation of a light beam along a straight line, etc. (without denying the existence of quantized "absorptions" but only for certain frequencies set forth by the medium);

8) The general absence of light itself within physical media since they are are generally opaque to light, thus voiding of physical content not only SR but also all formulations based on light;

9) The shift of the frequency of light propagating within a gaseous medium, without any relative motion between the source, the medium and the detectors, as experimentally confirmed; and other reasons.

INAPPLICABILITY 3.VI: SR is inapplicable to systems that are irreversible over time. The very axioms of SR have no "time arrow," thus being valid indeed for the reversible systems of the original conception (such as an electron orbiting around a nucleus or a proton in a particle accelerator). Consequently, SR exhibits irreconcilable structural inconsistencies when applied to irreversible systems (such as a proton collid-

ing at high energy with a nucleus). In fact, serious graduate schools in physics can show to students that, in the case of irreversible systems, SR equally predicts the event forward as well as that backward in time (trivially from the quadratic character of the Minkowski line element), with consequential violation of causality. In reality, the inapplicability of SR for irreversible systems is quite deep and originates from the insufficiency of the very mathematics used in 20th century physics, that characterized by Lie algebras (since the Lie product is invariant under anti-Hermiticity, thus solely characterizing reversible systems).

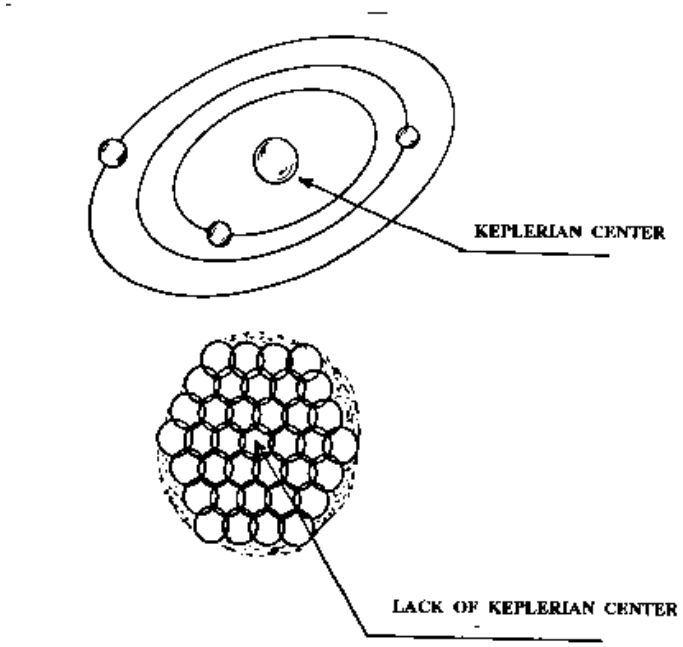

Figure 5: *This figure provides is a conceptual rendering on the fact that relativistic quantum mechanics cannot possibly be exactly valid for the nuclear structure because "nuclei have no nuclei" and, consequently, the Lorentz-Poincaré symmetry cannot possibly be exactly valid due to the absence of a Keplerian center in the nuclear structure. This is another case of scientific obscurantism due to the wide acceptance of relativistic quantum mechanics as being exactly valid for the nuclear structure and the dismissal if not the discreditation of qualified covering views. In this memoir we shall promote a scientific renaissance in nuclear physics via quantitative representations of the nuclear structure as being composed of protons and neutrons under potential as well as "contact" interactions without a Keplerian center and their direct experimental verifications.*

INAPPLICABILITY 3.VII: SR is unable to provide a consistent representation of antimatter. This occurrence is nowadays known as *one of the biggest scientific imbalances of the 20th century physics,* because matter was studied at all possible levels,

from Newtonian mechanics to second quantization, while antimatter was solely studied at the level of second quantization. This evident imbalance is due to the fact that the sole conjugation available for SR for the map from matter to antimatter and vice versa is the sign of the charge. This implies the complete inability by SR to distinguish between *neutral* matter and antimatter. Even for the case of charged particles, serious inconsistencies have been identified because, following quantization, the operator image of a classical "antiparticle" according to SR is a "particle" with the wrong sign of the charge (since there is only one quantization channel). The scientific reality nowadays admitted by serious scholars is that antimatter was discovered decades after the formulation of SR and that the "application" of SR to antimatter was voiced by Einstein followers. Again, Albert Einstein is not responsible for the above identified major scientific imbalance of the 20th century physics.

Above all, the author wants to express strong objections against the widely used statement "the universal constancy of the speed of light" due to its excessively political character, since the serious scientific statement is that verified by experiments, namely, **the universal constancy of the speed of light when propagating in vacuum and referred to inertial frames.**

It is evident that the resolution of all the above limitations of SR, as well as of others we could not possibly treat for brevity, will require studies by generations of scholars. Hence, in this paper we shall review the laborious studies by the author and his group in achieving an axiom-preserving covering of SR allowing applications to broader conditions identified below.

4. Exterior and Interior Dynamical Problems.

There are no "serious" theoretical grounds we are aware of for any particle, including neutrinos, to travel faster than the speed of light under Conditions 2.I, 2.II and 2.III, historically referred to as characterizing *exterior dynamical problems*, where "serious" means the absence of directly unverifiable conjectures. We therefore exclude oscillations, tachyons, imaginary "dark springs," and other conjectures, because virtually anything can be claimed under sufficiently far fetched imaginary hyperbolas.

This impossibility is due to the fact that, under the indicated assumptions, we can only have action-at-a-distance interactions derivable from a potential. These interactions are technically known as *variationally selfadjoint (SA) interactions,* as studied in technical details in monographs [1] (which were written when the author was at MIT in 1974-1977, initially released as MIT preprints jointly with papers in the corresponding field theoretical formulations, and finalized following a seminar course in the field delivered by the author at Harvard University in 1977-1978). In fact, under sole SA interactions, it takes infinite energy to accelerate any particle to the speed of light, and the achievement of any superluminal speed can be proved to violate causality, energy conservation, and other physical laws, in full agreement with the 20th century formulation of SR. The use

of directly unverifiable conjectures is then disproved by these violations.

The only possibility known to the author for achieving superluminal speeds in a way verifying causality, energy conservation and other physical laws, is that particles and electromagnetic waves propagate within physical media, which conditions are historically referred to as characterizing *interior dynamical problems*. As indicated in the 1982 paper[2], due to the absence of "point-like wavepackets," the latter conditions imply the existence of contact, zero-range interactions due to wave overlapping which are are *non-linear* (in the wavefunction), *non-local* (of integral type not reducible to a finite collection of isolated points) and *non-potential*, thus not representable with a Hamiltonian or a Lagrangian. The latter are technically known as *variationally nonselfadjoint (NSA) interactions* [1].

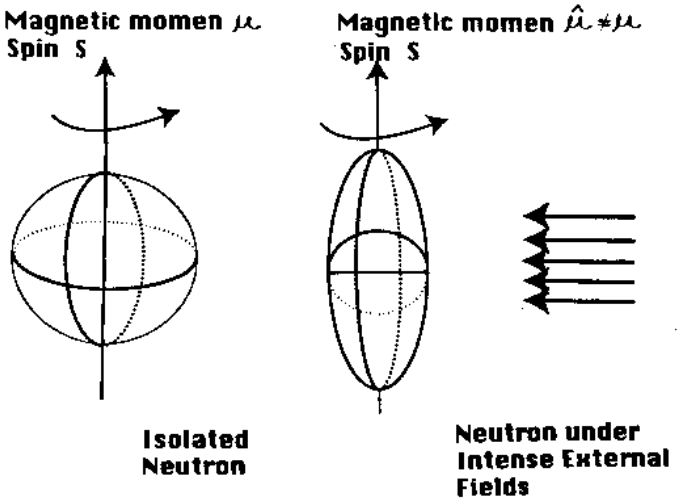

Figure 6: *A theory can be claimed as being exactly valid under certain conditions when, and only when said theory represents "all" experimental data from unadulterated first principle. Consequently, relativistic quantum mechanics cannot be considered as being exactly valid in nuclear physics, not only for the reasons depicted in the preceding figure, but also for its inability in about one century of resolving rather embarrassing deviations from the predicted nuclear magnetic moments and the experimental data. This is yet another case of scientific obscurantism in contemporary physics because the only possibility for an exact representation of nuclear magnetic moments is that via the deformation of nucleons when members of a nuclear structure. The obscurantism emerges from the fact that this old and quite plausible hypothesis is widely dismissed because it implies the inapplicability of relativistic quantum mechanics in its very foundations, the rotational symmetry. In this memoir we shall attempt to stimulate a renaissance in the field via an exact representation of nuclear magnetic moments in terms of a broader realization of the axioms of relativistic quantum mechanics.*

In turn, the non-Hamiltonian or non-Lagrangian character implies that the time evolution of NSA interactions is necessarily *non-canonical* at the classical level, and *non-unitary* at the operator level. The verification of causality and all other physical laws for super-

luminal speeds is then reduced to the use of the appropriate mathematical and physical elaboration whose achievement required decades of solitary research (see below).

By keeping in mind the above distinctions, **the primary objective of this paper is to provide a guide amidst the rather large literature that has been accumulated over past decades on the novel mathematics, theoretical and experimental methods worked out for the specific study of closed-isolated interior dynamical problems, namely, systems of extended particles that are isolated from the rest of the world, thus verifying the conventional, ten total conservation laws, but their internal forces are of nonlinear, nonlocal, nonpotential, thus precluding the representation of the entire system via a Hamiltonian or a Lagrangian.**[7]

In order to minimize possible mis-representations of the above central objective, let us dispel the rather naive belief, primarily due to lack of technical knowledge of the field, according to which "conventional total conservation laws of Galileo or Einstein relativities are impossible under nonconservative forces". Thanks to the prior availability of the powerful and rigorous conditions of variational self-adjointness studied in Volume [1a] and Volume [1b] disproved such a belief via the following:

LEMMA 4.I: The verification of the following conditions by variationally nonselfadjoint (thus non-Hamiltonian) forces among two or more particles

$$\sum_{k=2,...N} F_k^{\rm NSA} = 0, \tag{4.1a}$$

$$\sum_{k=2,...,N} p_k * F_k^{\rm NSA} = 0, \tag{4.1b}$$

$$\sum_{k=2,...,N} r_k \wedge F_k^{\rm NSA} = 0. \tag{4.1c}$$

where $*$ and $\wedge$ denote scalar and vector products, respectively, assure the verification of all ten Galilean conservation laws, thus characterizing closed-isolated non-Hamiltonian interior dynamical systems.[8]

Regrettably, in order to avoid a prohibitive length, this paper must be restricted to relativistic formulations of closed-isolated non-Hamiltonian systems for which the dual features of maintaining the conventional ten total conservation laws of the LP symmetry and the presence of internal NSA forces is assumed by the novel geometry, algebra and topology.

However, scholars seriously interested in learning the new field are suggested to study first the covering of the Galileo relativity for interior conditions from Refs. [1b,4] and then pass to the corresponding covering of SR. In any case, that was the line of study followed by the author to avoid excessive up-front complexities as well as because no relativistic covering theory can be claimed as being valid without a valid nonrelativistic limit.

[7]Note that the condition of particles propagating within physical media does not include possible tunneling effects studied by G. Nimtz and others (see below).

[8]Note that an isolated particle cannot have nonconservative forces, thus explaining the restriction of Lemma 4.I to a minimum of two particles.

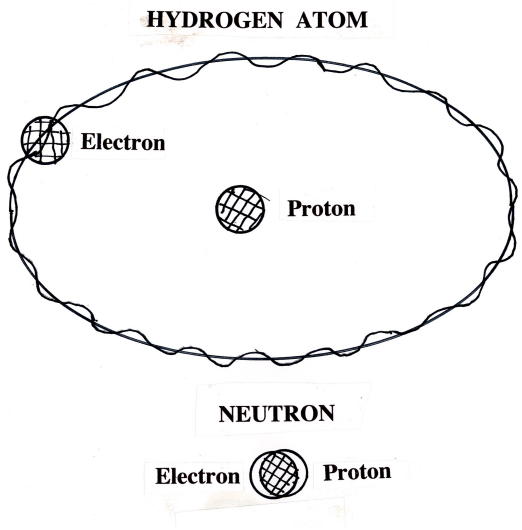

Figure 7: *Following the historical achievement of quantum mechanics for the exact representation of all experimental data for the structure of the hydrogen atom from unadulterated first axioms, quantum mechanics is widely believed as being exactly valid for all possible conditions existing in the universe. This posture is yet another case of scientific obscurantism in contemporary physics because quantum mechanics is known to fail for the synthesis of the neutron as the compressed hydrogen atom in the core of a star according to Rutherford. This is due to the fact that the rest energy of the neutron is bigger than the sum of the rest energies of the originating particles, under which conditions we would need a "positive binding energy" for which the Schrödinger equation no longer provides physically meaningful solutions. The scientific obscurantism is implemented in this case by merely ignoring, if not dismissing, quantitative representations of all characteristics of the neutron in its synthesis from the hydrogen atom, despite rather important implications for much needed new clean energies. In this memoir we shall also promote a scientific renaissance in the field via the addressing, rather than its ignorance, of the synthesis of the neutron since is is the first and most fundamental nuclear synthesis, thus being at the foundation of serious research in nuclear fusions.*

5. Initial Formulation of IsoRelativity

In paper [3] of 1983, the author proposed the characterization of interior dynamical problems via the general isotopic lifting of the Minkowski space $\hat{M}(x, \hat{T}\eta, I)$ characterized by the following most general possible, symmetric and non-singular line element in $(3+1)$-dimensions (see Eq. (2) of Ref. [3] and, more generally, Eq. (3.19) of Ref. [4b])

$$x^{\hat{2}} = x^{\mu} g_{\mu\nu}(x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...)x^{\nu} =$$

$$= x^{\mu}\hat{T}^{\rho}_{\mu}(x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...))\eta_{\rho\nu}]x^{\nu} =$$

$$\frac{x_1^2}{n_1^2} + \frac{x_2^2}{n_2^2} + \frac{x_3^2}{n_3^2} - \frac{t^2c^2}{n_4^2}), \tag{5.1}$$

where: the positive-definite quantities [9]

$$n_{\mu} = n_{\mu}(x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...) > 0,\ \mu = 1, 2, 3, 4, \tag{5.2}$$

are called the *characteristic quantities* of the medium considered; their values are derived from experimental data; they are normalized to the value $n_{\mu} = 1, \mu = 1, 2, 3, 4$ for the vacuum; their primary function is a geometrization of the inhomogeneity and anisotropy of the medium considered; and they have the most general possible dependence on all needed local variables, such as coordinates x, velocities v, accelerations a, energy E, density d, frequency ω, temperature τ, wavefunctions ψ, derivatives of the wavefunctions $\partial\psi$, and other variables.

In particular, the formulation of the isotopic line element (5.1) is restricted in the x-coordinates of the experimenter, while prohibiting the use of the usual transformations to hypothetical reference frame without physical relevance, a feature referred to in the literature as *direct geometric (or analytic) representation.*

In essence, the main idea of paper [3] was that of lifting the conventional Minkowski metric η into the most general possible nonsingular and symmetric metric in $3+1)$-dimensions

$$\eta \ \rightarrow \ g_{\mu\nu}(x, v, a, E.d, \omega, \tau, \psi, \partial\psi, ...) = \hat{T}^{\rho}_{\mu}(x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...)\eta_{\rho,\nu}; \tag{5.3}$$

via the multiplication of the positive-definite 4×4 matrix $\hat{T}$

$$\hat{T}(x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...) = Diag.(1/n_1^2, 1/n_2^2, 1/n_3^3, 1/n_4^2) > 0. \tag{5.4}$$

a lifting submitted under the name of *spacetime mutation.* The resulting theory was called "isotopic" (beginning with the title of paper [3]) in the Greek sense of being "axiom preserving" by conception, a feature generally represented with the prefix "iso." The technical realization of the isotopic lifting was evidently realized via the positive-definiteness of the characteristic quantities n_{μ}, or of the mutation matrix $\hat{T}$.

[9] The generalized line element proposed in paper [3] and monographs [4] was formulated in terms of the characteristic quantities $b_{\mu} = 1/n_{\mu}$. The use of the quantities n_{μ} is nowadays more generally adopted because of the direct meaning of n_4 as the index of refraction.

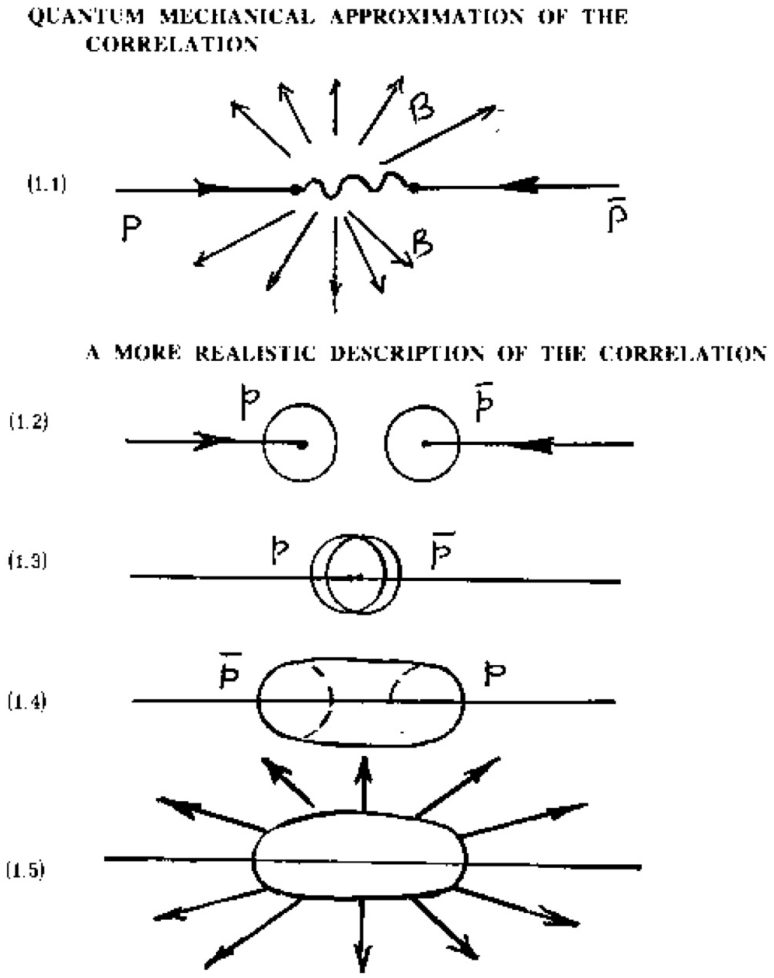

Figure 8: *The Bose-Einstein correlation conceptually depicted in this figure is yet another case of scientific obscurantism because relativistic quantum mechanics is claimed as being exactly valid while in reality the fit of experimental data requires four arbitrary parameters (the chaoticity parameters) that cannot possibly be admitted by vacuum expectation values for two-dimensional Hermitean operators of the two point correlation function. The scientific obscurantism emerges in this case from the widely accepted silence on the evidence that the four chaoticity parameters constitute direct evidence on the impossibility for relativistic quantum mechanics to be exactly valid for the Bose-Einstein correlation. In this memoir we shall attempt a scientific renaissance in the field via an exact representation of experimental data under a broader realization of the axioms of relativistic quantum mechanics whose vacuum expectation values for the two-points correlation function do indeed admit four arbitrary parameters that actually provide a numerical representation of the very elongated proton-antiproton fireball.*

Thanks to the prior construction of the needed new mathematics, with particular reference to the *axiom-preserving isotopies of Lie's theory* indicated below, the author constructed in paper [3], apparently for the first time, the universal symmetry of general spacetime (5.1), today known as the *Lorentz-Poincaré-Santilli (LPS) isosymmetry.* For the sub case of transformations in $3,4$-dimensions, we have the *Lorentz-Santilli transforms* (see Eq. (15) of Ref. [3] and Eqs. (5.29) of Ref. [4b]), again expressed for $x_4 = tc$ and $\eta = Diag.(1, 1, 1, -1)$[10]

$$x^{1'} = x^1, \;\; x^{2'} = x^2, \tag{5.5a}$$

$$x^{3'} = \hat{\gamma}(x^3 - \beta x^4), \tag{5.5b}$$

$$x^{4'} = \hat{\gamma}(x^4 - \hat{\beta} x^3), \tag{5.5c}$$

where

$$\beta = \frac{v}{c}, \;\; \hat{\beta} = \frac{v_3/n_3}{c/n_4}, \;\; \hat{\gamma} = \frac{1}{\sqrt{1 - \hat{\beta}^2}}. \tag{5.6}$$

The above symmetry then allowed the unique and unambiguous characterization also in paper [3] of the following main features (see Ref. [3] and Section IV-9 of Ref. 4b, where the isolaws considered below are presented as physical "Postulates"):

1) The *speed of light* becomes locally variable according to the familiar law

$$C = \frac{c}{n_4(x, v, a, E.d, \omega, \tau, \psi, \partial\psi, ...)}, \tag{5.7}$$

and its value is completely unrestricted by the formalism, thus being smaller, equal or bigger than c depending on the local conditions of the medium considered;

2) The Minkowskian light cone is mutated into the covering *light isocone* in the desired s-space direction s and time t

$$\frac{x_s^2}{n_s^2} - \frac{t^2 c^2}{n_4^2} = 0; \tag{5.8}$$

3) The *maximal causal speed* then assumes the consequential form

$$V_{max} = c\frac{n_s}{n_4}; \tag{5.9}$$

4) The *mass-energy isoequivalence* in the s-directionassumes the covering form (see later on for deeper versions)

$$\hat{E} = mc^2 \frac{n_s^2}{n_4^2}; \tag{5.10}$$

and

5) The *frequency shift law* assumes the covering form for the case of null aberration

$$\omega = \frac{\omega_0}{(1 \pm v n_4/c n_3) + ...)}. \tag{5.11}$$

[10]See later on the current fully symmetric formulation of the Lorentz-Santilli isotransforms with the sole use of $\hat{\beta}$.

Note, the abandonment of the speed of light as the maximal causal speed in favor of the covering isolaw (5.9) that, of course, recovers c as the maximal causal speed for the vacuum. The use of broader speed (5.9) is necessary for interior dynamical problems on numerous grounds, we shall see better later on, such as: the need to avoid the violation of causality for particles traveling faster than the local speed of light while preserving the validity of the relativistic addition of speed; the generally opaque character of physical media for which the speed of light has no physical meaning and other reasons.

Note also that, in SR, Axioms 2.I to 2.V are the same in all space directions. By contrast, within physical media, the maximal causal speed, inertial masses, etc., cannot be the same in all directions due to the inhomogeneity and anisotropy of the considered medium (as it is the case, e.g., for our atmosphere), thus being dependent on the desired space direction.

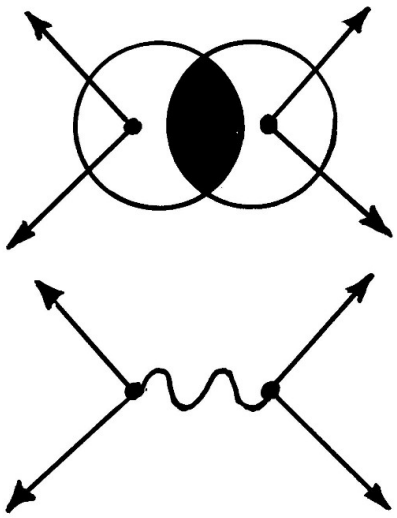

Figure 9: *Yet another case causing uneasiness is the broadening of the use of Feynman's diagrams, from the historical conditions of their conception, to very high energy scattering events. The broadening is based on the conjecture that all hadronic constituents are point like for the intent of maintaining the notion of interaction mediated by particle exchange also for high energy scattering events (lower view). However, the author has pointed out various times that "there exist no point-like wavepackets in nature." Consequently, the scattering region is composed by a hyperdense medium (top view) with consequential impossibility (at sufficiently high energies) for particle exchanges to occur. The uneasiness is also caused by the use of trillions of dollars of public funds in large colliders to search for the Higgs boson that cannot exist within hyperdense scattering regions and its experimental verification has failed to date. There, before the expenditure of additional public funds in high energy scattering, we have to implement a scientific renaissance in which all quantitative views are equally admitted and respected.*

The above and other physical deviations from SR were then treated in the first comprehensive form in monographs [4] of 1991. The resulting covering of SR was initially

presented under the name of *isospecial relativity* due to the joint study in the 1990s of the *isotopies of general relativity.* Subsequent studies revealed that the latter isotopies are contained as a particular case of the former and the resulting covering of SR was called *IsoRelativity* (IR).

As an illustration, all possible (nonsingular) Riemannian line elements are simple particular cases of the much more general isospacetime (5.1). In fact, paper [3] achieved, for the first time to our knowledge, the universal invariance of all infinitely possible Riemannian line elements. However, isospacetime (5.1) is dramatically more general than the Riemannian line elements, thus allowing the initiation of the study of aspects, such as the interior gravitational problems, that is essentially prohibited by the Riemannian geometry, as we shall see.

6. Compatibility of Superluminal Speeds with Einstein abstract Axioms.

We are now sufficiently equipped to indicate in a preliminary way the author's way of honoring the memory of Albert Einstein, that of showing the compatibility of his abstract axioms with superluminal speeds. A more technical presentation will be possible only later on in this paper, following the identification of the applicable mathematics.

For this purpose, we rewrite the light isocone (5.8) in the standard form via the use of definition (5.9)

$$x_3^2 - t^2c^2\frac{n_3^2}{n_4^2} = x_3^2 - t^2V_{max}^2 = 0; \tag{5.8}$$

for which isotransforms (5.5) become

$$x^{1'} = x^1, \;\; x^{2'} = x^2, \tag{6.2a}$$

$$x^{3'} = \gamma(x^3 - \beta x^4), \tag{6.2b}$$

$$x^{4'} = \gamma(x^4 - \beta x^3), \tag{6.2c}$$

where

$$\beta = v/V_{max}, \;\; \gamma = 1/\sqrt{1-\beta^2}. \tag{6.3}$$

and this proves the following:

LEMMA 6.1 [3] The Lorentz-Santilli isotransforms "coincide" with the conventional Lorentz transformations under the sole assumption that the symbol "c" in the latter represents an arbitrary speed, rather than the speed of light in vacuum. Consequently, arbitrary speeds (5.9), whether superluminal or subluminal, are compatible with the abstract formulation of special relativity.

The above important property can be seen from the following independent approach:

Figure 10: *As a complement of the preceding figure, this picture illustrates the impossibility for Einstein's theories and relativistic scattering methods to be exactly valid for high energy scattering events because the former theories are reversible over time while the latter events are strictly irreversible. On historical grounds, the exact validity of Einstein's theories for the dynamical evolution of particles in accelerators has been assumed as reason for the validity of the same theories also when particle collide with nuclei without a serious inspection of their limitations. The axiomatically correct and time invariant treatment of irreversibility in scattering events has requested the breaking of the anti-Hermitean symmetry of the Lie product via the covering Lie-admissible algebras proposed by the author during his Ph. D. Thesis and then developed in subsequent decades. These irreversible aspects are not treated in this memoir (see volumes [18] for brevity).*

LEMMA 6.2 [3]: The Minkowski-Santilli isospace $\hat{M}(x, \hat{T}\eta, I)$ is locally isomorphic to the conventional Minkowski space $M(x, \eta, I)$ to such an extent that all their differences disappear at the abstract, realization-free level.

The most important property underlying this section can be expressed as follows:

LEMMA 6.3 [3]: the Lorentz-Santilli isotransforms are locally isomorphic to the conventional Lorentz transforms to such an extent that all differences disappear at the abstract realization-free level.

Stated in plain language, the entire formulation of the covering IR can be made via the 20th century formulation of SR, and merely subject its symbols to a broader realization, such as assuming c an arbitrary velocity.

It is hoped that the above preliminary lines illustrate, for the scholar seriously interested in honoring the memory of Albert Einstein (rather than abusing it for personal gains), illustrate the far reaching *physical* implications in the broadening of the arena of applicability of the abstract Einstein axioms. The equally far reaching *mathematical* and *experimental* implications will be indicated in the subsequent sections.

7. The Long and Solitary Journey Toward Maturity.

The mathematically and physically consistent formulation of the covering IR required decades of solitary research due to the complexity and novelty of the problems to be identified and solved. To avoid a prohibitive length, in this section we shall outline the main aspects of this journey, with the understanding that a technical knowledge can be solely acquired via the study of the quoted literature all available in free pdf download.[11]

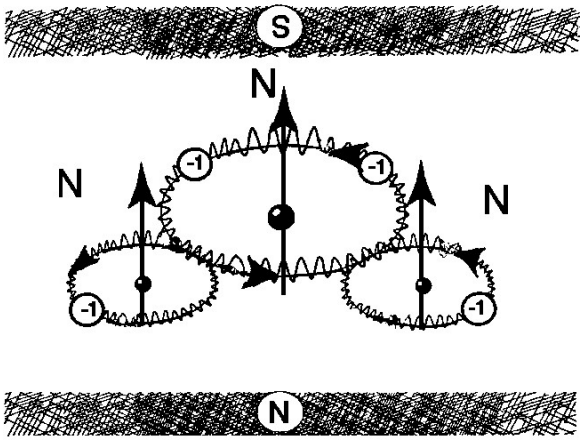

Figure 11: *In this figure we provide a conceptual rendering of the insufficiencies of quantum mechanics in chemistry here represented with the prediction of the paramagnetic character of the water molecule in dramatic disagreement with experimental evidence. As proved by a graduate student of the author when he was at Harvard University, the above erroneous prediction is the result of basic insufficiencies of the 20th century notion of valence due to the absence of an actual "attractive" bond in a pair of valence electrons in singlet couplings, by keeping in mind that identical electrons are predicted to "repel" each other by quantum mechanics and definitely not to attract each other. The loose character of the valence atomic orbitals then implies the prediction of their paramagnetic character. In this memoir. we attempt to promote a scientific renaissance in quantum chemistry beginning with more adequate, quantitative notion of valence bonds with possible important advances in various quantitative fields.*

7.I: SOLUTION OF THE HISTORICAL LORENTZ PROBLEM.

As well known to historians, Lorentz originally attempted the achievement of the invariance of the speed of light of his time, the locally variable speed (5.7), but failed to achieve his objective and was forced to study the particular case with constant speed of light, $C = c, n_4 = 1$, by writing in the process a central page of physics.

When at MIT in the mid 1970s, the author conducted an in depth analysis of the problem, today known as the *historical Lorentz problem,* and discovered that Lorentz's failure

[11]Lectures on the scientific journey outlined in this section in a language accessible to the general educated physics audience are available in Level III of the *World Lecture Series* http://www.world-lecture-series.org, particularly Lectures III A and IIIB.

was due to insufficiencies of the basic Lie's theory, because such a theory can solely characterize linear, local-differential and Hamiltonian systems, while the characterization of the locally varying speed (5.7) is highly nonlinear, nonlocal and non-Hamiltonian, since it deals with the speed of light propagating within physical media.

The solution of the historical Lorentz problem, first achieved in paper [3] of 1983 (see Eqs. 5.5), required a decade of research for the prior construction of a covering of Lie's theory specifically intended for the characterization of nonlinear, nonlocal and non-Hamiltonian systems at large, the historical Lorentz problem being an evident particular case.

Among a variety of possible alternatives, the authors selected the axiom-preserving *isotopies of Lie's theory* along with the teaching of the history of science according to which the axiomatic structure of a theory should be abandoned in favor of broader axioms only when proved to be necessary. [12]

The step-by-step isotopic, therefore axiom-preserving lifting of the various branches of Lie's theory (enveloping associative algebras, Lie algebras, Lie transformation groups, etc.) was first achieved in memoir [5a] of 1978 while the author was at Harvard University. The main idea, still fully valid to this day, is to lift the conventional associative product AB between arbitrary quantities A, B (such as functions, vector-fields, matrices, operators, etc.) into the form

$$AB \ \rightarrow \ A\hat{\times}B = A\hat{T}B, \tag{7.1}$$

where $\hat{T}$, called by the author the *isotopic element,* is fixed and positive definite (e.g., a matrix of the same dimension as that of A, B) with the most general possible, unrestricted functional dependence as in Eqs. (5.1),

$$\hat{T} = \hat{T}(x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...) > 0. \tag{7.2}$$

It is evident that the new product $A\hat{\times}B$ is still associative, although of a form more general than that used in 20th century sciences. For this reason, the new product was called by the author *isoassociative product* or *isoproduct* for short [5a].

The isotopic lifting of the associative product then permitted the systematic compatible lifting of the enveloping associative algebras $\xi(L)$ via the isotopies of its infinite di-

[12] The isotopies of Lie's theory are amply sufficient for quantitative representations of closed-isolated non-Hamiltonian systems studied in this paper. However, said isotopies are basically insufficient for the broader open-irreversible non-Hamiltonian systems, in which case the Lie-isotopic axioms have to be abandoned, as a condition to represent irreversibility, in favor of the more general axioms of *Lie-admissible theories,* also called *genotopic theories* [5]. In turn, Lie-admissible axioms have to be abandoned in favor of broader multi-valued hyperstructural axioms for biological structures, because necessary to attempt a quantitative understanding, e.g., of the production of an extremely complex living organism from an extremely small DNA. Still in turn, the Lie, Lie-isotopic, Lie-admissible and hyperstructural axioms have to be all abandoned in favor of the *isodual Lie, isodual Lie-isotopic, isodual Lie-admissible and isodual hyperstructural axioms* to achieve a consistent classical representation of "neutral" (as well as charged) antimatter. In summary, the reader should be aware that, for brevity, in this paper we solely review "isotopic" theories out of seven levels of treatments in classical and operator versions (see Figure 5, monographs [11,18] or the general review by J. V. Kadeisvili and I. Gandzha [100]).

mensional base via the *Poincaré-Birkhoff-Witt-Santilli isotheorem* originally formulated in Ref. [5a].

The antisymmetric algebra $\hat{L} \approx [\hat{\xi}(\hat{L})]^-$ attached to the isoassociative envelope $\hat{\xi}(\hat{L})$ is then characterized by the product

$$[A\hat{,}B] = A\hat{\times}B - B\hat{\times}A = A\hat{T}B - B\hat{T}A, \tag{7.3}$$

that verifies the conventional Lie axioms in an their abstract formulation,

$$[A\hat{,}B] + [B\hat{,}A] = 0, \tag{7.4a}$$

$$[[A\hat{,}B]\hat{,}C] + [[B\hat{,}C]\hat{,}A] + [[C\hat{,}A]\hat{,}B] = 0. \tag{7.4b}$$

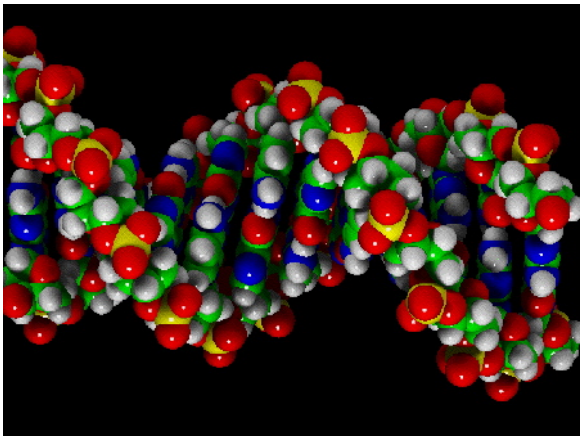

Figure 12: *Yet another field of contemporary research causing great uneasiness, is the study of the DNA via 20th century mathematics, physics and chemistry. The insufficiency of 20th century mathematics is established by its single-valued character (e.g.,* $2 \times 2 = 4$*), while the very notion of one single DNA generating a large organism requires multi-valued mathematics (e.g.,* $2 \times 2 =$ *ordered set of values). The insufficiency of 20century quantum mechanics is established by the consequential prediction of the DNA, from basic quantum axioms, as being perfectly rigid and perfectly eternal. The insufficiency of 20th century chemistry is established buy the widespread dubbing of the DNA as a "molecule" when it is trivial to prove that available valence electrons cannot possibly bond a structure that contains* 10^10 *atoms or more. A scientific renaissance has been promoted by the author in the study of the DNA via covering multi-valued mathematical, physical and chemical methods because of the implication for the human health, let alone the scientific advances, although this field is not considered in this memoir for brevity (see Volumes [18] and original references quoted therein).*

For this reason, the author called product (7.3) *Lie-isotopic product.*

The "exponentiation" of the isotopic algebra thanks to the Poincaré-Birkhoff-Witt-Santilli Theorem then permitted the *isotopies of Lie transformation groups,* also achieved

for the first time in Ref. [5a] and today called *Lie-Santilli isogroups* (see Section 8 for the application of Lie-Santilli isogroup to the explicit realization of the Lorentz-Poincaré-Santilli isosymmetry)[13]

The non triviality of the emerging theory was established also in memoir [5a] by showing that, thanks to the lifting of the enveloping algebra and related infinite dimensional basis, the "exponentiation" of isotopic Lie algebras into isotopic transformation groups required the lifting of the conventional exponentiation, e.g., of the time evolution for a Hamiltonian H, into the form

$$e^{Hti} \ \rightarrow \ e^{H\hat{T}ti}, \tag{7.5}$$

thus exhibiting the positive-definite isotopic element $\hat{T}$ with an arbitrary functional dependance *in the very exponent of the transformations*, and consequently assuring the non triviality of the theory because of its direct applicability to nonlinear, nonlocal and non-Hamiltonian interior problems.

Following the above laborious preparatory research, the achievement of the desired algebraic characterization of closed-isolated non-Hamiltonian systems was direct and immediate. In fact, the isotopies of a Lie algebras, e.g., of the Lorentz-Poincaré algebra, leave the generators unchanged, since the isotopies merely lift the *operations* among conventional generators, but not the generators themselves. This assures the preservation under isotopies of the ten conventional Galilean or relativistic conservation laws. The representation of internal non-Hamiltonian interactions is assured by the presence, besides the conventional Hamiltonian, of the isotopic element $\hat{T}$ in all possible products.

The emerging covering theory is today known as the *Lie-Santilli isotheory* (see, e.g., review monographs [6] by the Greek mathematicians Gr. Tsagas and D. S. Sourlas, monograph [7] by the Russian applied mathematician J. V. Kadeisvili and numerous other references identified in the general review by J. V. Kadeisvili and I. Gandzha [110]).

The main solution of the historical Lorentz problem was achieved in a few lines of paper [3] because of the prior construction of the above indicated isotopies of the various branches of the 20th century formulation of Lie's theory. However, the mathematically and physically consistent solution required decades of additional research outlined in this section. Due to its fundamental character for isorelativity, the isosymmetry for all infinitely possible locally varying speeds of light is presented in details in Section 8.

7.II: INVARIANCE OVER TIME OF NON-HAMILTONIAN INTERACTIONS:
As recalled earlier, a reason for the "majestic consistency" of 20th century Hamiltonian theories is their capability of predicting the same numerical values under the same conditions at different times. As well known, this crucial property is due to the *canonical* character of classical Hamiltonian theories and the *unitary* character of their operator images.

[13]In inspecting Ref. [5a], interested scholars should be aware that this memoir was primarily intended for the first presentation scientific records of the broader *Lie-admissible Lifting of Lie's theory*, of which the Lie-isotopic theory is a simple subcase. Hence, most of the results for the latter theory are presented in memoir [5a] in their covering Lie-admissible form.

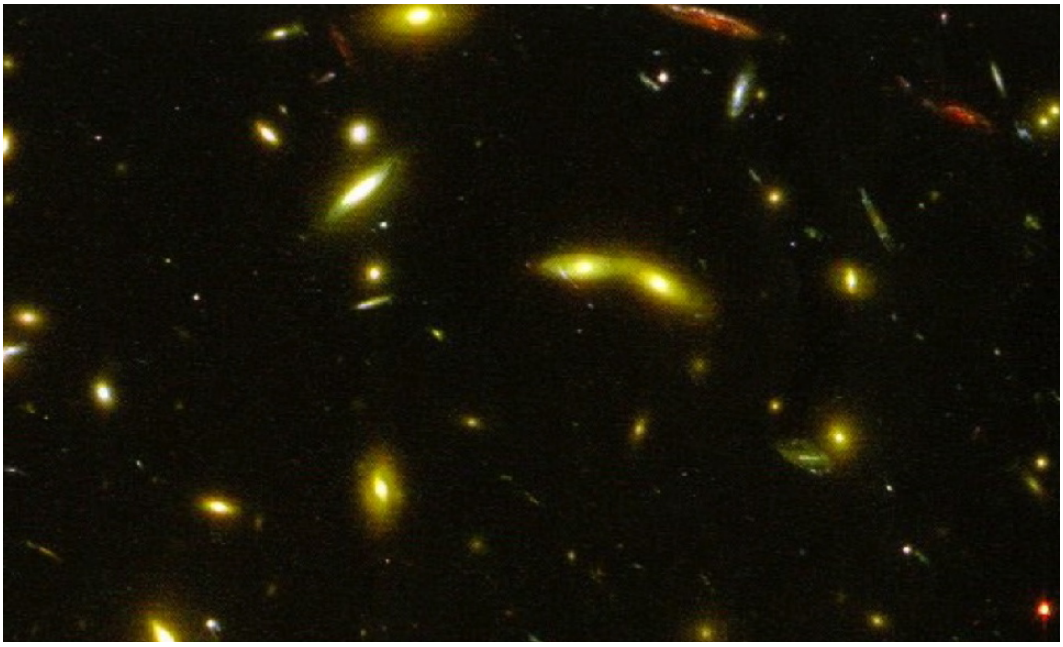

Figure 13: *Yet an additional case of scientific obscurantism requiring its identification as a premise for advances is the current condition of cosmology because it is plagued by a chain of conjectures, each one proposed in support of a preceding unverifiable conjecture, such as the expansion of the universe, the acceleration of the expansion, the big bang, the expansion of space itself, etc., all conjectures implying a return to the Middle Ages with Earth at the center of the universe from the very Hubble law (the expansion of space itself cannot represent the acceleration of the expansion, thus also implying Earth at the center of the universe because the expansion is the same for the same distance from Earth in all directions in space). This scientific obscurantism is made more serious by the dismissal for about one century of the comparatively much more plausible hypothesis by Fritz Zwicky on the "Tired Light" because the evidence of the inability by scattering to cause redshift is not sufficient to dismiss the possible loss of energy by light to intergalactic gases without any expansion of the universe. The most unreassuring aspect of this obscurantism mandating a scientific renaissance in cosmology is that all currently dominating conjectures are preferred to the more plausible Zwicky's hypothesis because the latter hypothesis violates Einstein's theory while the former conjectures are aimed at the studious but unspoken intent of maintaining the validity of Einstein's theories throughout the universe via a chain of conjectures each known to be experimentally unverifiable, thus imposing far reaching and clearly implausible cosmological models under large public funds via academic authority rather than experimental evidence.*

By contrast, any non-Hamiltonian (i.e., NSA) theory is, by conception and technical realization, *non-canonical* at the classical level and *non-unitary* at the operator level. The direct consequence is the loss by non-Hamiltonian formulations of the axiomatic beauty of Hamiltonian theories, with far reaching mathematical and physical inconsistencies, as established by the following theorem (for a review and original reference, one can inspect Vol. I of monographs [18]):

INCONSISTENCY THEOREM 7.1: All classical non-canonical and operator non-unitary theories, when treated with the mathematics of canonical and unitary theories, respectively, do not preserve over time their basic unit, thus having catastrophic mathematical inconsistencies (loss over time of the basic numerical field with consequential collapse of the entire mathematics built on it), as well as catastrophic physical inconsistencies (loss over time of the basic units of measurements, loss of the same numerical predictions under the same conditions at different times, loss over time of observables, and other inconsistencies).

Following countless failed attempts, the only solution identified by the author assuring the invariance over time of non-linear, non-local and non-Hamiltonian interactions was their representation with a generalization of the basic unit, from the trivial value 1 of 20th century theories, to a positive-definite (as a condition to have an isotopy) function, matrix or operator $\hat{I}$ with the most general possible non-linear, non-local, integro-differential functional dependence,

$$1 \ \rightarrow \ \hat{I}((x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...) > 0, \tag{7.6}$$

today known as *Santilli isounit.* The reason for this selection is that, besides the Hamiltonian, the basic unit is the assured invariant of any theory. Geometric compatibility arguments, required that the isounit must be the inverse of the isotopic $\hat{I}$ element $\hat{T}$ causing the mutation of spacetime (5.1),

$$\hat{I} = 1/\hat{T}(x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...) > 0. \tag{7.7}$$

A number of physical verifications and applications then restricted the isounit to be the product of terms representing the geometry of the body considered (including its density) multiplied by an exponential term representing the non-Hamiltonian interactions.

As an illustration, for the case of two particles in deep mutual penetration of their wavepackets (even when having a point-like charge, such as for two valence electrons as illustrated in Figure 4), the nonrelativistic isounit is given by

$$\hat{I} = \Pi_{k=1,2} Diag.(n_{k1}^2, n_{k2}^2, n_{k3}^2) e^{F(r,\psi,...) \int d^3(r) \ \psi_1^\dagger(r) \ \psi_2(r)} > 0, \tag{7.8}$$

with easily identifiable relativistic extensions (see monograph [11b] for details).

In fact, the represented interactions are clearly non-linear because of the function $F(r, \psi, ...)$ in the exponential, non-local of the intended integro-differential character because of the integral also in the exponential, and manifestly non-Hamiltonian in the sense that said interactions could be representable with any quantity *except* the Hamiltonian.

Note that the construction of an isotheory over isounit (7.8) assured its covering character over 20th century formulation, because the unit $I = Diag.(1, 1, 1)$ of the Euclidean space is trivially admitted as a particular case for point-like particles under which the characteristic n-functions must have the unit value, and the volume integral in the exponent must be null due to impossibility of volume overlapping for point particles.

The use of the base unit was indeed promising for the invariant representation of nonlinear, non-local and non-Hamiltonian interactions, but it implied the loss of the base field of the theory with consequential inability to properly define geometries, algebras, etc., let alone the impossibility of conducting measurements. In fact, as well known, all mathematical representations of physical events must be formulated over a numeric field that, in turn, is centered on its unit. The loss of the latter then causes the collapse of the consistency of the entire formalism, as expressed by Inconsistency Theorem 7.1.

As it is also well known, all possible numeric fields $F(n, \times, 1)$ with elements n, conventional associative product $nm = n \times m$ for all $n, m \in F$ and for the unit 1 had been classified by historical masters such as Gauss, Cayley, Hamilton and others, and they resulted in being given by *real numbers, complex numbers and quaternions* (octonions are not considered as being "numbers" because they violate the associative axiom of a numeric field). The respect for said masters prevented the author for years to inspect the indicated classification.

Finally, in summer of 1993, while visiting the *Joint Institute for Nuclear Research* in Dubna, Russia, mostly out of desperation due to the impending loss of decades of research, the author had the courage of re-inspecting the historical classification of numbers and discovered that *the abstract axioms of a numeric field do not require the basic unit necessarily be the trivial number* 1. This observation allowed the discovery, apparently for the first time in Ref. [8] of 1993, of the following isotopies of numeric fields

$$F(n, \times, 1) \ \rightarrow \ \hat{F}(\hat{n}, \hat{\times}, \hat{I}), \tag{7.9a}$$

$$\hat{n} = n\hat{I} = n \times \hat{I}, \ \hat{n}\hat{\times}\hat{m} = \hat{n} \times \hat{T} \times \hat{m} = nm\hat{I}, \ \hat{I} = 1/\hat{T} > 0, \tag{7.9b}$$

where the isoproduct is the same as that for the Lie-Santilli isotheory, Eq. (7.1), and the term "isotopies" is intended to indicate the property that the infinitely possible images $\hat{F}(\hat{n}, \hat{\times}, \hat{I})$ of a given field $F(n\times, 1)$ (because of infinitely possible isounits for each F) fully verify all axioms of a numeric field. This discovery led to new numbers today known as *Santilli isoreal, isocomplex and isoquaternionic numbers* (see also monograph [9] by the Chinese mathematician C-X. Jiang and the comprehensive literature in Vol. I of Ref. [18]).

Note that the isounit $\hat{I}$ can be *outside* the original field F, in which case we have *Santilli isofields of the first kind* generally denoted $\hat{F}(\hat{n}, \hat{\times}, \hat{I})$ or $\hat{I}$ can be, as a particular case, an element of the original field, in which case we have *Santilli isofields of the second kind* which are generally written in the simplified form $\hat{F}(n, \hat{\times}, \hat{I})$ (because in this case $n\hat{I}$ is an ordinary number, e.g., $\hat{n} = n\hat{I} \in F$). In this paper we shall solely use isofields of the first kind as necessary to treat interior dynamical problems. However, the reader should be aware that isofields of the second kind are intriguing. As an example, for the case isoreal numbers and $\hat{I} = 3$ we have $2\hat{\times}3 = 2$ and 4 is a prime number.

The discovery of the isonumbers was a crucial step forward for the time invariant representation of non-linear, non-local and non-Hamiltonian interactions because physics requires a mathematical representation predicting numbers that must be subjected to experimental verifications. Hence, in the author's view, a theory without "numbers" (that is, sets verifying the axioms of a numeric field) no visible physical value.

Note that even though the notion of numbers is generalized, the actual numbers predicted by isotopic theories for experimental verifications are conventional due to the cancellation of the isounit with the isotopic element, as it is the case, for instance, with the *Schrödinger-Santilli isoequation* 9see Section 7.IV below:

$$H\hat{\times}|\hat{\psi}>=H(r,p)\hat{T}(r,p,\psi,...)|\hat{\psi}>=\hat{E}\hat{\times}|\hat{\psi}>=E|\hat{\psi}>,\ \ \hat{E}\in\hat{F},\ \ E\in F. \tag{7.10}$$

Note incidentally that the embedding of all non-linear effects in the isotopic element allows the regaining of the superposition principle at the isotopic level (which is violated for conventional non-linear theories), thus allowing the consistent treatment of composite systems with non-linear internal interactions, a feature prohibited to quantum mechanics when interactions non-linear in the wavefunctions are represented with the Hamiltonian.

The discovery of isonumbers permitted the consistent formulation of *isospaces,* that is, metric or pseudo-metric spaces formulated over an isofield. For instance, the Minkowski-Santilli isospacetime achieved the consistent formulation

$$\hat{M}(\hat{x},\hat{\eta},\hat{I}),\ \hat{x}=x\hat{I},\ \hat{\eta}=\hat{T}\eta=g,\ \hat{I}=1/\hat{T}>0, \tag{7,11}$$

and therefore, for consistency, must be formulated in terms of *isospacetime coordinates* $\hat{x}=x\hat{I}\in\hat{F}$ as a condition for being isonumbers, with *isoline element*

$$\hat{x}^{\hat{2}}=\hat{x}^{\mu}\hat{\times}\hat{\eta}_{\mu\nu}\hat{\times}\hat{x}^{\nu}=[x^{\mu}(\hat{T}^{\rho}_{\mu}\eta_{\rho\nu})x^{\nu}]\hat{I}\in\hat{F}, \tag{7.12}$$

that too, to be an isonumber, must be multiplied by the isounit.

For future needs, note the crucial assumption that $\hat{I}$ *is the isounit for both the base isofield and of the isospace.* By comparison, in 20th century formulations of SR, the unit of the numeric field is the *number* 1 while the unit of the Minkowski space is the *matrix* $I=Diag.(1,1,1,1)$.

Therefore, for consistency under isotopies, we shall formulate SR via a single unit for both the base field and the spacetime

$$F'(n',\times',1),\ n'=nI,n\times'm=nmI,\ 1'=Diag.(1,1,1,1), \tag{7.13}$$

with ensuing simple reformulation of the Minkowski space over F'

$$M'(x',\eta',1'),\ \ x'=x1'\in F',\ \ \eta'_{\mu,\nu}=\eta_{\mu\nu}1'\in F', \tag{7.14a}$$

$$x'^2=x'^{\mu}\times/\eta'_{\mu\nu}\times'x'^{\nu}=(x^{\mu}\eta_{\mu\nu}x^{\nu})1'. \tag{7.14b}$$

The above seemingly trivial reformulation of the Minkowski spacetime allowed the author to discover the following *new symmetry of conventional spacetime,* first achieved in Ref. [28] of 1993,

$$\eta\ \rightarrow\ \eta'=k\eta,\ \ 1'\ \rightarrow\ 1"=1'/k,\ k\in F,k>0, \tag{7.15}$$

with related invariance of the line element

$$(x^\mu \eta_{\mu\nu} x^\nu)1' \equiv [x^\mu (k\eta_{\mu\nu}) x^\nu](I/k) = (x^\mu \eta'_{\mu\nu} x^\nu)1" \tag{7.16}$$

that proved to have far reaching implications for unified field theories, operator images of gravity, and other important advances we plan to indicate later on [20].

At this moment, we limit ourselves to recall that, contrary to the popular belief throughout the 20th century that the Poincaré symmetry has ten dimensions, the new invariance (7.16) proves the following property:

THEOREM 7.2 [28]: The Lorentz-Poincaré symmetry has eleven dimensions.

Following the laborious reformulation in term of isofields of all isotopies achieved prior to 1993, including the *isofunctional analysis, Lie-Santilli isotheory, isomechanics,* etc., the emerging isotopic theories still *failed* to achieve the crucial invariance over time. Additional years of repeated inspections of the entire formalism failed to identify the origin of the lack of invariance. Finally, in summer 1995, during the *Second International Conference on Lie-Admissible Formulations* help at the Longodard Castle of Prince Pignatelli in Italy, the author identified the origin of the lack of invariance where it was suspected the least, in the ordinary differential calculus.

In essence, the differential calculus used in 20th century physical theories had remained unchanged since its formulation by Newton and Liebnitz. In particular, ordinary differential expressions such as the differential of a variable and the partial derivative of a function

$$dx, \quad \frac{\partial F(x,...)}{\partial x}, \tag{7.17}$$

were tacitly assumed in both mathematics and physics as being independent from the unit of the base field.

This *tacit* assumption was evidently correct for the trivial unit 1, but evidently incorrect when the unit of the base field depends on the differentiation variable. This observation led the author to discover the *isotopies of the differential calculus* apparently for the first time in Refs. [10,11] of 1995-1996, now known as *Santilli isodifferential calculus* with basic *isodifferentials* and *isoderivatives*

$$\hat{d}\hat{x} = \hat{d}[x\hat{I}(x,...)] = \hat{T}d[x\hat{I}(x,...)] = \hat{T}\hat{I}dx + \hat{T}xd\hat{I}, \tag{7.18a}$$

$$\frac{\hat{\partial}\hat{F}(\hat{x},...)}{\hat{\partial}\hat{x}} = \hat{I}\frac{\partial\hat{F}(\hat{x},...)}{\partial\hat{x}} \tag{7.18b}$$

where d and ∂ are the conventional expressions. Evidently, isodifferentials and isoderivatives coincide with the conventional expressions when the isounit is a constant or it is independent from the differentiation variables, but the above expressions are otherwise non trivially different than conventional ones, with far reaching implications at all levels of study, particularly for the experimental verifications.

The discovery of the isodifferential calculus sealed the achievement of mathematical maturity for the formulation of isotopic theories. Their detailed treatment was presented

in monographs [11] that remain the most comprehensive presentations of isotopic theories to this day (see also the review monograph [12] by J. V. Kadeisvili).

Numerous additional mathematical advances then followed, among which we quote the achievement of maturity for a new topology by the Spanish mathematicians R. M. Falcon Ganfornina and J. Nunez Valdes in Ref. [13] (following initial studies quoted therein by N. Tsagas and the author), nowadays called the *TSGV isotopology.* To understand this paper, the reader should be aware that *the TSGV isotopology is crucial for a consistent representation of extended, therefore non-spherical and deformable particles.*

7.III. ANALYTIC REPRESENTATION OF NON-HAMILTONIAN INTERACTIONS
All the preceding rather voluminous research was merely intended as preliminary for a main physical objective, the achievement of an analytic representation of non-linear, nonlocal and non-Hamiltonian interactions, thus NSA verifying the following five conditions:

CONDITION 7.I: The analytic representation must be "directly universal" [1b], i.e., admitting the representation of all possible NSA interactions ("universality"), directly in the frame of the experimenter ("direct universality");

CONDITION 7.II: To be analytic, the representation must occurs in term of a first-order action principle (namely, an action functional solely containing first order differentials of phase space variables);

CONDITION 7.III: The representation must verify the ten total Galilean and Poincaré conservation laws at the nonrelativistic and relativistic levels, respectively, while admitting internal NSA interactions;

CONDITION 7.IV: As a necessary condition of compatibility with isomathematics, the analytic representation must be an axiom-preserving realization of the abstract axioms of conventional Hamiltonian mechanics (that without external terms);

CONDITIONS 7.V: The analytic representation must admit a unique and unambiguous operator image by characterizing axiom-preserving isotopies of quantum mechanics today known as the isotopic branch of hadronic mechanics [5].

The achievement of the analytic representation of NSA interactions verifying the above five conditions resulted in being, by far, the author's most laborious scientific journey that lasted for about half a century.

To prevent a prohibitive length, we can hereon merely indicate the most important aspects, in the hope that the outline may help interested colleagues in preventing the waste of their research along lines already proved as being without serious scientific value.

Let us begin by recalling the fundamental *Newton's equations* as originally conceived with the sole separation of SA (potential) and NSA (non-potential) forces

$$m_\rho \frac{dv_{k\rho}}{dt} = F^{SA}_{k\rho}(t, r, v) + F^{NSA}_{k\rho}(t, r, v, a, ...), \quad k = 1, 2, 3, \quad \rho = 1, 2, ..., N, \tag{7.19}$$

where one should keep in mind the general dependence of NSA forces on *accelerations* a,

e.g., of centrifugal type,[14] under the condition that the NSA forces verify closure conditions (4.1) ensuring conventional conservation laws [1b].

The historical representation of the above equations is that via the *true Lagrange and Hamilton equations, those with external terms, that were generally "truncated" in 20th century physics for the evident reason to achieve compatibility with Einsteinian theories.* For instance, by ignoring hereon for simplicity the subindex ρ denoting particle, the *true Hamilton equations* are given by

$$\frac{dr^k}{d\hat{t}} = \frac{\partial H}{\hat{\partial} p_k}, \quad \frac{dp_k}{dt} = -\frac{\partial H}{\partial r^k} + F^{NSA} k(t, r, a, ...), \tag{7.20}$$

with corresponding version for the *true Lagrange equations.*

Unfortunately, the above representation violates all Conditions 7.I-7.V above for very well-known reasons, such as the absence of a representation via an action principle.

Additionally, the author discovered during his gradate studies at the University of Torino, Italy, in the mid 1960s that the brackets (A, H) of the time evolution of a physical quantity A characterized by the true Hamilton equations with Hamiltonian H

$$\frac{dA}{dt} = \frac{\partial A}{\partial r^k}\frac{\partial H}{\partial p_k} - \frac{\partial A}{\partial p_k}\frac{\partial H}{\partial r^k} - \frac{\partial A}{\partial p_k} F_k^{NSA} = (A, H), \tag{7.21}$$

violate the conditions to characterize an algebra as defined in mathematics (they violate the right distributive and scalar axioms). Therefore, in the treatment of NSA forces via the historical equations (7.20), we lose not only *all Lie algebras,* but more seriously we lose *all possible algebras,* thus preventing any dream of achieving a covering of conventional Hamiltonian formulations that, as well known, have a Lie algebra structure.

As part of his Ph. D. thesis, the author then discovered an *identical Lie-admissible reformulation of the true Hamilton's equations,* namely, a reformulation of Eqs.(7.20) in such a way that the brackets (A, H) of the time evolution law first verify all axioms of an algebra and then the algebra turns out to be Lie-admissible, e.g., a covering of Lie algebras (see monographs [11] for historical notes and original papers in the field).

This mid-1960s solution was developed in subsequent years to full operational maturity with a number of intriguing applications, e.g., the representation of irreversible processes that is inherent in the lifting of Lie-algebras into their Lie- admissible covering. However, Lie-admissible formulations solely apply for *open processes,* such as a spaceship during re-entry in our atmosphere, for which total conservation laws are replaced with their covering *time rate of variations of total quantities* [1a]. Consequently, Lie-admissible formulations are not suitable for the systems studied in this paper, namely, closed-isolated non-Hamiltonian systems verifying indeed conventional total conservation laws.[15]

[14] The reader should keep in mind that acceleration-dependent forces are generally considered as being non-Newtonian.

[15] Readers not expert in the field of this paper should know that the Lie-admissible formulations constitute the fundamental part of hadronic mechanics, since they admit the Lie-isotopic formulations of this paper as simple particular cases.

The search for an analytic representation of NSA systems verifying Conditions 7.I-7.V continued in the subsequent decades. The first analytic representation of the class of systems here considered was reached in the mid 1970s when the author was at MIT and released as MIT preprints to be subsequently published in monograph [1b]. The analytic representation here referred to is that characterized by the most general possible, first-order, action functional in phase space,[16]

$$\delta A = \delta \int_{t_1}^{t_2} (R_\mu(t, b, ...) db^\mu - B(t, b, ...) dt) = 0, \;\; b = (r, p), \;\; \mu = 1, 2, ..., 6. \tag{7.22}$$

The resulting analytic equations were first discovered by D. G. Birkhoff, for which reason the author called the emerging mechanics the *Birkhoffian mechanics* as stated beginning with the title of monograph [1b].

Birkhoffian mechanics did verify all the above conditions, except Condition 7.V, because the operator image of action principle (7.22) necessarily leads to "wavefunctions" dependent on the b-coordinates, namely, depending on both phase space coordinates, i.e., $\psi = \psi(t, r, p)$. The resulting covering of quantum mechanics is beyond our current operator knowledge and, therefore, the use of Birkhoffian mechanics had to be abandoned despite its proved "direct universality" for all possible systems (7.19) and its very elegant analytic features.[17]

A number of alternative mechanics were proposed when the author was at Harvard University up to the early 1980s and, subsequently, at the *Institute for Basic Research* on Harvard Grounds, which Institute was organized specifically to conduct research on non-Hamiltonian interactions. Unfortunately, none of these generalized mechanics resisted a severe scrutiny and, consequently, they had to be abandoned. A reason for these failures was the need to achieve compatibility with a rather diversified and complex array of conditions, the violation of only one of them being sufficient for rejection.[18]

In early 1990, following four decades of failed attempts, the author was left with no option other than that of reinspecting the basic equations, Newton's equations, since they had remained structurally unchanged since Newton's time. A critical examination soon revealed fundamental structural insufficiencies of Newton's equations, not for the conditions of their original conception (point-like particles), but for the conditions studied in this paper (extended particles moving within a resistive medium).

In fact, a point-particle simply cannot admit NSA interactions due to the evidence absence of resistive forces caused by lack of dimensions. This simple observation motivated

[16]There are action principles of second and higher orders that are mathematically beautiful but lose an algebra in the brackets of the time evolution law, besides lacking a unique and unambiguous operator image, thus being not suitable for the isotopies of 20th century Hamiltonian formulations.

[17]The author would like to express the view that, when future generations will be inevitably faced with the need to build a covering of hadronic mechanics, the lifting of conventional quantum wavefunction $\psi(t, r)$ into the full dependence $\psi(t, r, p)$ will be the logical step and, in this case, the Birkhoffian mechanics may acquire a basic role.

[18]Additional mechanics abandoned because of insufficiencies were presented in the first edition of monographs [11] and then removed from the second edition of 1995.

the construction of the first covering of Newton's equations in *Newtonian* (rather than relativistic) mechanics since Newton's time known to the author.[19]

Additionally, the history of sciences teaches that the origin of the lack of solution of basic physical problems protracted over time is generally due to the use for a *mathematics* insufficient for the task at hand. This teaching was confirmed by the studies herein reported because the use of a *new mathematics* emerged as being mandatory for an analytic representation of non-Hamiltonian forces verified all needed conditions.

In fact, there was the need for lifting Newton's equation into a form specifically formulated for extended, non-spherical and deformable particles, the need to reformulate the equations into a form verifying the integrability conditions for an analytic representation via a first order action functional, and other requirements solely achievable via an appropriate new mathematics.

After so many attempts, the desired covering of Newton's equations were finally achieved in 1995 following the discovery of isofields [8] and thanks in particular to the discovery of the isodifferential calculus [10,11]. The resulting *isotopies of Newtonian mechanics* are formulated on the following Kronecker product of isospaces

$$\hat{S}_{tot} = \hat{S}_t(\hat{t}, \hat{\times}, \hat{I}_t) \times \hat{S}_r(\hat{r}, \hat{\times}, \hat{I}_r) \times \hat{S}_v(\hat{v}, \hat{\times}, \hat{I}_v), \tag{7.23}$$

each isospace being defined with respect to the base fields of *isotime* $\hat{t} = t\hat{I}_t$, *isocoordinates* $\hat{r} = r\hat{I}_r$ and *isovelocities* $\hat{v} = v\hat{I}_v$. The resulting *Newton-Santilli isoequations* can then be written in their simplified form (see Ref. [11b] for the most general possible formulation)

$$\hat{m}\hat{\times}\frac{\hat{d}\hat{v}_k}{\hat{d}\hat{t}} - \hat{F}_k^{SA} = Diag.(n_1^2, n_2^2, n_3^2)[m\frac{dv_k}{dt} - F_k^{SA}(t, r, v) - F_k^{NSA}(t, r, v, a, ...)] = 0. \tag{7.24}$$

with simple realization of the isounits

$$\hat{I}_t = 1, \;\; \hat{t} = t, \;\; \hat{I}_r = 1, \;\; \hat{r} = r, \;\; \hat{v} = v \times \hat{I}_v, \tag{7.25a}$$

$$\hat{I}_v = Diag.(n_1^2, n_2^2, n_3^2) exp(\frac{t}{mv} F^{NSA}), \tag{7.25b}$$

permitting the "directly universal" representation of all possible Eqs. (7.24) (see again [11b] for the solution of the general case).

Note that the n-characteristic quantities represent the extended shape of the particle are here assumed as being constant for simplicity, although they are variables for the general case depending on local conditions of size, pressure speed, acceleration, etc.[20]

As one can see, the main mechanics for the transition from Newton's equations to Newton-Santilli isoequations is that of embedding all NSA forces in the generalized unit

[19]The communication of alternative generalizations of Newton's equations in Newtonian mechanics with underlying geometries and topologies permitting a consistent representation of extended particles moving within resistive media, if any, would be greatly appreciated.

[20]Note the forceful emergence of Santilli isounit of type (7.8), with the representation of non-Hamiltonian interactions via an exponential. The exponential structure of the isounit begins at the Newtonian level, and then continues to emerge at all subsequent levels of study.

of the mechanics, thus guaranteeing their invariant representation. The SA character of the isoequations then allows their analytic representation via a first-order action principle, as shown below.

In summary, the long scientific journey here outlined confirms that Newton's equation are and remain the most fundamental equations in physics. The same journey also reveals that structural insufficiencies of Newton's equations (e.g., their excessive abstraction of particles as being point-like) carry over to all subsequent levels of treatment.[21]

Following about half a century of attempts, the advent of the isodifferential calculus finally permitted the achievement of the analytic representation verifying all conditions 7.I to 7.V characterized by the following *first-order, directly universal isoaction principle* first achieved in Ref. [10,11]

$$\hat{\delta}\hat{A} = \hat{\delta}\int_{t_1}^{t_2}(\hat{p}_k\hat{\times}\hat{d}\hat{r}^k - \hat{H}\hat{\times}\hat{d}\hat{t}) = \hat{\delta}\int_{t_1}^{t_2}[p_k \times \hat{T}^k_{\hat{r},i}(t,r,p,...)\times\hat{d}\hat{r}^i - \hat{H}\times\hat{T}_{\hat{t}}\times d\hat{t}] = 0, \qquad (7.26)$$

with ensuing the *Hamilton-Santilli isoequations*

$$\frac{\hat{d}\hat{r}^k}{\hat{d}\hat{t}} = \frac{\hat{\partial}\hat{H}(\hat{r},\hat{p})}{\hat{\partial}\hat{p}_k} = I_p\frac{\partial\hat{H}(\hat{r},\hat{p})}{\partial\hat{p}_k} = \frac{\hat{p}_k}{\hat{m}} = \hat{I}_p\frac{p_k}{m}, \qquad (7.27a)$$

$$\frac{\hat{d}\hat{p}_k}{\hat{d}\hat{t}} = -\frac{\hat{\partial}\hat{H}(\hat{r},\hat{p})}{\hat{\partial}\hat{r}^k} = \hat{I}_r\frac{\partial\hat{H}(\hat{r},\hat{p})}{\partial\hat{r}^k} \qquad (7.27b)$$

and directly universal solution for all infinitely possible systems (7.24), here expressed for the simpler case with $\hat{I}_t = \hat{I}_p = 1$)

$$\hat{I}_r = \frac{F^{SA}(t,r,p) + F^{NSA}(t,r,p)}{F^{SA}} \qquad (7.28)$$

The brackets of the time evolution of a quantity $\hat{A} \in \hat{S}_{tot}$, instead of brackets (7.21), are given by

$$\frac{\hat{d}\hat{A}}{\hat{d}\hat{t}} = \frac{\hat{\partial}\hat{A}}{\hat{\partial}\hat{r}^k}\frac{\hat{\partial}\hat{H}}{\hat{\partial}\hat{p}_k} - \frac{\hat{\partial}\hat{A}}{\hat{\partial}\hat{p}_k}\frac{\hat{\partial}\hat{H}}{\hat{\partial}\hat{r}^k} = [\hat{A,H}], \qquad (7.29)$$

where $\hat{A}, \hat{H}$ are defined on $\hat{S}_{tot}$, thus providing a classical realization of the Lie-Santilli isoalgebras.

We then have the following *Hamilton-Jacobi-Santilli isoequations* [*loc. cit.*]

$$\frac{\hat{\partial}\hat{A}}{\hat{\partial}\hat{t}} + \hat{H} = 0, \qquad (7.30a)$$

[21] It should be indicated that the author has identified *seven* inequivalent liftings of Newton's equations, the isotopic lifting here considered plus the genotopic lifting for open single-valued irreversible systems, the hyperstructural lifting for open, irreversible and multi-valued systems, plus four isodual versions for neutral (or charged) antiparticles, the isodual conventional, the isodual isotopic, the isodual genotopic, and the isodual hyperstructural equations, each of which characterizes, via mere compatibility arguments, corresponding mechanics at the foundation of hadronic mechanics (see Figure 5 and Refs. [11]).

$$\frac{\hat{\partial}\hat{A}}{\hat{\partial}\hat{r}^k} - \hat{p}_k = 0, \tag{7.30b}$$

$$\frac{\hat{\partial}\hat{A}}{\hat{\partial}\hat{p}_k} \equiv 0. \tag{7.30c}$$

The above equations are evidently at the foundation of operator maps, and illustrate again the crucial role of the isodifferential calculus for all isotopies.[22]

Note also the formal identity at the abstract level of conventional Hamiltonian mechanics and its isotopic image. This illustrates that the abstract axioms of Hamiltonian mechanics have representational capability dramatically broader than those believed for centuries, although said broader representational capabilities can be seen only via the using the appropriate broader mathematics.

Despite the apparently simplistic character, there are a number of technical aspects in the elaboration of isomechanics that generally cause misrepresentations by non-experts in the field. One of them is that the elaboration of the Hamilton-Santilli isomechanics via the conventional functional analysis leads to inconsistencies similar to the elaboration of the conventional mechanics via the isofunctional analysis that generally escape the awareness of non-experts in the field.

7.IV. OPERATOR REPRESENTATION OF NON-HAMILTONIAN INTERACTIONS:

7.IV.1: From historical achievement to scientific obscurantism.

Parallel to the historical achievements of the Lorentz-Poincaré-Einstein special relativity for point particles and electromagnetic waves propagating in vacuum (exterior dynamical conditions), relativistic quantum mechanics achieved equally historical advances for the same physical conditions, with parallel achievements for Galileo relativity and quantum mechanics for nonrelativistic exterior conditions.

The dimension of these achievements should be noted. The founders of quantum mechanics, such as Plank, Schrödinger, Heisenberg, Bohr, Fermi, and others constructed an entirely new mechanics based on a new mathematics (Hilbert spaces, etc.), and reached numerically exact representations from unadulterated basic axioms of all experimental data for the hydrogen atom, namely, for an entity that could not be seen with the naked eye.

The validity of quantum mechanics for the representation of point-like particles in vacuum was confirmed in the second half of the 20th century by the equally historical achievement of the classification of all particles via the Gell-Mann SU(3) symmetry, subsequently extended via high level treatments to the *standard model,* which is hereon assumed as an excellent (although not necessarily unique) classification of particles into families.[23]

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[22]For the case of the Birkhoffian mechanics with action functional (7.26), $\hat{\partial}\hat{A}/\hat{\partial}\hat{p}_k \neq 0$ thus implying wavefunctions with both r, p dependence as indicated earlier. This is a primary reason the Birkhoffian mechanics had to be abandoned for the studies herein reported.

[23]The reader should be aware of the existence of the complementary particle classification by Erik Trell, in the *Proceedings of the 2011 International Conference on Lie-admissible Formulations for Irreversible Pro-*

As a result of these historical achievements, quantum mechanics was tacitly assumed to be exactly valid to all infinitely possible conditions existing in the universe, such as the structure of the strongly interacting particles (hadrons) and, consequently, the structure of nuclei and stars, as well as to all structural problems at large (interior dynamical problems). The specific intent of maintaining the validity of quantum mechanics in the transition from exterior to interior problems within the hyperdense medium inside hadrons, was achieved via the conjecture that the purely mathematical fundamental representations of the $SU(3)$ symmetry, called quarks, are the ultimate physical constituents of hadrons.

More specifically and technically, the maintaining of Einsteinian doctrines and quantum mechanics for the structure of hadrons, nuclei and stars was crucially based on the *purely point-like conjecture of the structure of the conjectural quarks,* since the mathematical and physical axioms of said theories are solely applicable for point-like particles.

However, besides proving to be scientific sterile for about half a century, and constituting a major political obstruction against further basic advances in particle physics (such as new energies originating in the structure of individual hadrons, rather than their collection indicated later on), the conjecture that quarks are the ultimate constituent of matter has created a scientific obscurantism of equally historical proportions.

The transition from the majestic scientific achievements in the first half of the 20th century to the scientific obscurantism in the second half is due to a number of aspects, such as: the systematic "disqualification" via the abuse of scientific credibility of any qualified theoretical and experimental research on the inapplicability of quantum mechanics for interior structural problems; the dismissal by organized interests on Einsteinian doctrines and quantum mechanics of the plethora of inconsistencies of quark conjectures without any visible scientific motivation; the resulting, still ongoing waste of trillions of dollars of taxpayer's money in "experimental verifications" of webs of far fetched conjectures, each one formulated in support of the preceding, manifestly inconsistent conjectures, all studiously aimed at maintaining the validity of Einsteinian doctrines and quantum mechanics in interior physical problems; and other unreassuring occurrences.[24]

In reality, quarks are what they are: purely mathematical unitary irreducible fundamental representations of a purely mathematical internal symmetry, defined on a purely mathematical complex-valued unitary space. As such, it is known by serious scholars, to qualify as such, that *quarks cannot be consistently defined in our spacetime,* because of the impossibility of defining them via representations of the Lorentz-Poincaré symmetry, the O'Rafaertight Theorem, and numerous other reasons.

Since quarks cannot be even defined in our spacetime, the conjecture that they are

cesses, Kathmandu University, Nepal, http://www.santilli-foundation.org/docs/Nepal-2011.pdf In essence, both the standard and Trell's classifications are based on the SU(3) symmetry and its various extensions. However, the particle classification in the standard model is based on the *Lie-algebra,* while Trell's classification is based on the *root diagrams* of the same algebra. Despite the seemingly innocuous difference, the standard model requires a number of assumptions, while Trell's classification is quite remarkable, because it requires only one numerical input, the rest energy of the proton.

[24]See the author's denunciations [14,15] of 1984-1985 and, for subsequent denunciations, one may visit numerous websites, such as website www.scientificethics.org

actual physical particles is truly far fetched, and manifestly political, because of a plethora of inconsistencies, such as: the impossibility for quarks to experience gravity according to Einstein's own views; the impossibility for the so dubbed "quark masses" to represent inertia; the impossibility that quarks are truly confined, that is they have an identically null probability of tunnel effects, etc. (see memoir [16] of 1981 for the author detailed presentation and the 2007 book by the British scientist Jeremy Dunning Davies [17]).

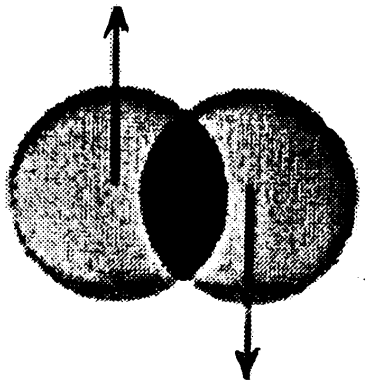

Figure 14: *A schematic view of the central interactions described by IsoRelativity, the deep mutual penetration and overlapping of the wavepackets of particle in singlet coupling even when having point-like charges, as it is the case for the valence electron coupling (as well as other cases, such as the synthesis of the π^0 meson, the synthesis of the neutron) resulting in interactions that are non-linear, non-local, and manifestly non-Hamiltonian, thus solely representable via IsoRelativity in an invariant way. Recall that identical electrons repel each other according to quantum mechanics and, therefore, quantum mechanics cannot possibly be exact for molecular structures. Hadronic Chemistry [19] has resolved this inconsistency by showing that NSA interactions are strongly attractive, by permitting exact representations of molecular structure (as well as other structures) from unadulterated first principles.*

All these and several other inconsistencies of quark conjectures, all published in refereed journals, have been ignored, and their authors "disqualified" by organized interest on Einstein and relativistic quantum mechanics currently controlling academia without any visible scientific motivation.[25]

[25]As one illustration among too many for comfort, the Jewish-American physicist Leon Lederman, when director of FERMILAB, released an official announcement in the 1990's on the "discovery of the top quark," a manifestly political statement intended to maintain the validity of Einsteinian doctrines in the interior of the hyperdense hadrons, because the correct scientific statement should have been "discovery of new particles predicted by the conjectural top quark," since the same particles are predicted by other theories without quarks conjectures. Even as recently that Spring 2012, Leon Lederman released in an interview for a scientific program broadcast in the national U. S. television, the statement that "quarks are truly elementary point particles without any structure," however, without the statement that this was his personal belief and

Above all, quark conjectures violate the historical teaching from the study of atoms, according to which their classification was reached by Mendeleev via the use of pre-existing knowledge, while the compatible structure of individual atoms required the construction of a new mechanics (quantum mechanics). Hence, the current rather widespread belief that one single theory, the standard model, both the classification of particle and their individual structure is equivalent to the belief that the classification of atoms and their individual stricture can be achieved via the sole use of the Mendeleev classification.

In this paper we shall adopt the basic assumptions of the original memoirs [5], namely: quantum mechanics is valid for exterior dynamical problems; the covering hadronic mechanics is valid for the broader interior dynamical problems; and the constituents of unstable particles are ordinary physical particles produced free in the spontaneous decays, generally those with the lowest mode. In turn, the latter identification allows the conception and quantitative study of new clean energies originating in the interior of individual hadrons, as well as additional intriguing advances (for comprehensive studies, see the five volumes of the 2008 series [18]).

7.IV.2. Historical Notes on Hadronic Mechanics.

The proposal to build a covering of quantum mechanics under the name of hadronic mechanics was submitted by the author in memoirs [5] of 1978 based on the lifting of Lie algebras structure of quantum mechanics into the covering Lie-isotopic algebra with isoproduct (7.3) [5a], and consequential lifting of Heisenberg equation into the finite and infinitesimal forms [5b]

$$(A(t) = (e^{H\hat{T}ti})A(0)(e^{-it\hat{T}H}), \tag{7.31a}$$

without the disclosure that such assumptions are necessary to maintain the validity of Einsteinian theories for the hadronic structure. When the author was at Harvard University under DOE support in the early 1980, a period in which quark conjectures became "established," the author, and Italian-American scientidst, brought repeatedly to the attention of the Jewish-American physicists Leon Lederman, Steven Weinberg, Shelly Glashow, Sidney Coleman, Herman Feshback, and their affiliates around the world, the fact that *there exist no point-like wavepackets in nature.* hence, despite the conjectural point-like charge, hadronic constituents are in conditions of total mutual penetration of their wavepackets, resulting in unavoidable non-linear, non-local and non-Hamiltonian interactions under which the assumption of the exact validity of Einstein's doctrines and quantum mechanics is essentially political. However, when exposed to such physical evidence published in memoirs [5a. 5b,16] and others, rather than dismissing the evdience in refereed publications, the Jewish-American physicists in control at the time of the Physics Department at Harvard (Steven Weinberg, Shelly Glashow, and Sidney Coleman) stated publicly that "Santilli's studies have no physical value" [14,15]. Subsequently, in the early 1990s, following the rejection by the journals of the APS of hundred of papers on hadronic mechanics and its applications without any visible or otherwise credible review, the author requested the U. S. Senator Bilirakis from Florida to contact the APS editor of the time, the Jewish-American physicist Leon Lederman, asking clarification on so many rejections of highly technical and qualified papers (sine of which presenting basically new clean energies so much needed by America and mankind), Lederman re[pried Senator Bilirakis request by stating that "Dr. Santilli does not understand particle physics," thus again via the abuse of academic credibility due to the lack of credible counterarguments. All these, and too many other cases of scientific misconducts (see, e.g., www.scientificethics.org) have sealed the existence beyond doubt of an ongoing scientific obscurantism on Einsteinian doctrines and relativistic quantum mechanics for the benefit of a minoritarian group (see Refs. [14.15] and, thereafetr, website http://www.scientificethics.org/Santilli-ethical-decay.html

$$i\frac{dA}{dt} = [A\hat{,}H] = ATH - HTA, \;\; T > 0. \tag{7.31}$$

Since the lifting from a Lie product into its isotopic covering is non-unitary (see below),

$$[A, B] = AB - BA \to [A\hat{,}B] = ATB - BTA = U[A, B]U^\dagger, \;\; UU^\dagger \neq I, \tag{7.32}$$

memoir [5b] proposed, as the dynamical counterpart of Eqs. (7.31), a non-unitary covering of Schrödinger equations of the type

$$H|\psi >= E|\psi > \to U\,(H\,|\psi >)\,U^\dagger = U\,(E\,|\psi >)\,U^\dagger, \tag{7.33}$$

and applied the latter equation to the first known numerical representation of all characteristics of the π^0 meson as a "compressed positronium" (a bound state of an electron and a positron at $1\;fr$ mutual distances), which model is impossible for quantum mechanics because the rest energy of the π^0 requires about $134\;MeV\;more$ the sum of the rest energies of the constituents, under which conditions the Schrödinger equation is known to be inconsistent (see Section 5 of memoir [5b]).

The original proposal of 1978 stimulated a flurry of independent studies (see the historical lines and references of monographs [18a). However, Eqs. (7.31), (7.33) and all other generalizations were subsequently proved to violate causality and other basic laws in view of their non-unitary structure formulated on a conventional Hilbert space $\mathcal{H}$ over a conventional field $\mathcal{C}$, thus activated Inconsistency Theorem 7.1.

The Korean mathematician H. C. Myung and the Italian-American physicist R. M. Santilli [21] discovered in 1982 the correct form of the Hilbert space which is applicable to Eqs. (7.31)-(7.33), today known as the *Hilbert-Myung-Santilli isospace* and denoted $\hat{\mathcal{H}}$ (see, e.g., Ref. [21] and the vast literature by the Georgian applied mathematician J. V. Kadeisvili and the Ukrainian physicist I. Gandzha [100]). Nevertheless, isospace $\hat{\mathcal{H}}$ was still formulated on the conventional field $\mathcal{C}$, thus continuing to activate the indicated Inconsistency Theorem.

The discovery in 1993 of the isotopies of conventional fields [8] identified a major insufficiency of the preceding formulations of hadronic mechanics, but the time invariance of operator representation of non-Hamiltonian, thus non-unitary interactions remained elusive. It was only with the discovery of the isodifferential calculus in 1995 [10,11] that the isotopic branch of hadronic mechanics finally reached a consistent formulation, with particular reference to its invariance over time as outlined below in Section 7.V.

To understand the difficulties to be resolved, the reader should know that in 1994, some sixteen years following its proposal [5], hadronic mechanics still missed a consistent non-unitary formulation of the linear momentum, thus preventing applications and experimental verifications because, e.g., of the impossibility of formulating the much needed non-unitary image of the angular momentum. The correct formulation of the isolinear momentum was finally achieved thanks to: the Hilbert-Myung-Santilli isospace (1982); Santilli isofields (1993); and, above all, Santilli's isodifferential calculus (1995).

7.IV.3. Conceptual foundations of Hadronic mechanics.

The central assumption of hadronic mechanics is *the replacement of Plank's constant* $\hbar$

with a positive-definite integro-differential operator $\hat{I}$ assumed at the fundamental isounit at all levels of treatment,

$$\hbar = 1 > 0 \rightarrow \hat{I} = e^{F(r,\psi,...) \int d^3(r)\ \psi_1^\dagger(r)\ \psi_2(r)} > 0, \tag{7.34}$$

The above lifting is done for the specific intent that, *in the transition from particles in vacuum (exterior conditions) to particles within hyperdense media (interior conditions), we have the replacement of quantized energy levels with more complex, but covering energy exchanges,* where the word "covering" is intended the recovering of quantized energy exchanges whenever the particle return to propagate in vacuum (because in this case $\hat{I} \equiv 1$, the volume integral in the exponent of Eq. (7.34) being null).

As a specific example, *consider an electron when a member of an atomic structure and its well known quantized orbits. Hadronic mechanics predicts that the same electron when in the core of a star cannot have conventionally quantized absorption or emission of energy, trivially, because of extremely high local pressures of the order of* $10^{40}\ * psi/cm^2$, under which conditions the assumption that the orbits are necessarily discrete without direct experimental evidence is so far fetched to be essentially political.

The inapplicability within interior conditions of the notion of quantized energy exchanges (that has continued to dominate particle physics for about one century without a serious scrutiny) should not be surprising to serious scholars, because it occurs already in quantum chemistry for the most elementary and, therefore, most fundamental interior dynamical problems, the singlet coupling of valence electrons in molecular structures (see Figure 4).

We assume the reader is familiar with the failure by primitive quantum axioms (those based on the sole use of the Coulomb potential as done for the structure of atoms) to achieve an exact representation of the binding energy of the simplest possible molecules, such as H_2 or H_2O. As a result of this failure, the historical Coulomb potential had to be modified into the so-called *screened Coulomb potential,*

$$V = \frac{e^2}{r} \rightarrow V_{screened}(r) = f(r,...)\frac{e^2}{r}. \tag{7.35}$$

where the screening function $f(r)$ is fitted from the data, after which an exact representation of molecular binding energies was achieved and quantum chemistry claimed as being exact.

However, it is evident that *the screening of the Coulomb potential implies the loss of quantized energy exchanges,* since the latter are solely admitted by the unadulterated Coulomb potential. Consequently, generalized energy exchanges exist in molecular structures (although they have not been identified as generalized for evident political reasons). The need for the study of covering, integro-differential energy exchanges for more complex physical conditions, such as for particles in the core of a star, or along essentially the same lines, for the constituents of hadrons, is then evident to all ethically sound scholars.

Irrespective of the achievement of an exact representation of molecular binding energies, and irrespective of the scientifically inappropriate maintaining of the words "quantum chemistry" despite the loss of quantized energy exchanges, and other inconsistencies (e.g., the evident violation of Galilei relativity for screened Coulomb potential, the

violation of causality due to its non-unitary structure, etc.), the most fundamental insufficiency of "quantum" chemistry is the prediction that *two identical electrons repel (rather then attract) each other.* The achievement of an *attractive* bond between the two identical electron has been permitted by the covering *hadronic chemistry,* that has achieved the first known exact representation of molecular binding energies from unadulterated first principles without adulterations via arbitrary functions fitted from the data [19].

7.IV.4. Abstract Formulation of the Isotopic Branch of Hadronic Mechanics. With a clear understanding of the above mathematical, physical and chemical lines, we are now sufficiently equipped to outline the abstract formulation of the *isotopic branch of hadronic mechanics,* or *operator IsoMechanics* for short (see Figure 5 for the various remaining branches of hadronic mechanics).

Recall the conventional (also called naive) quantization

$$A = \int_{t_1}^{t_2} (p_k \times dx^k - H \times dt) \to -i\, \hbar\, Log\, \psi, \;\; \hbar = 1. \tag{7.36}$$

Its isotopic image, known as *Animalu-Santilli IsoQuantization* [20], is given by

$$\hat{A} = \int_{t_1}^{t_2} (\hat{p}_k \hat{\times} \hat{d}\hat{x}^k - \hat{H} \hat{\times} \hat{d}\hat{t}) \to -i\, \hat{Log}\hat{\psi} = -i\, \hat{I}\, Log\hat{\psi}, \tag{7.37}$$

where $\hat{Log}$ denotes *IsoLogarithm,* with corresponding isotopies for the symplectic and other operator maps [11].

It is evident that IsoQuantization does indeed imply the replacement of Planck constant $\hbar = 1$ with the integro-differential isounit $\hat{I}$ along the fundamental assumption (7.34) of hadronic mechanics.

The axiomatically correct, and time invariant, isotopic image of Schrödinger equation was reached in Ref. [10,11], today known as *Schrödinger-Santilli isoequation,* it is formulated on the isospace $\hat{\mathcal{H}}$ over the isofield $\hat{\mathcal{C}}$, and can be written (see Refs. [11b] for a detailed treatment)

$$\hat{i} \hat{\times} \hat{\partial}_{\hat{t}} |\hat{\psi}(\hat{t}, \hat{r}) >= \hat{H} \hat{\times} |\hat{\psi}(\hat{t}, \hat{r}) >= \hat{E} \hat{\times} |\hat{\psi}(\hat{t}, \hat{r}) >, \tag{7.38}$$

with *isolinear momentum,* first formulated in 1995 [*loc. cit.*]],

$$\hat{p}_k \hat{\times} |\hat{\psi}(\hat{t}, \hat{r}) >= -\hat{i} \hat{\times} \hat{\partial}_k |\hat{\psi}(\hat{t}, \hat{r}) >, \tag{7.39}$$

canonical isocommutation rules

$$[\hat{r}^{\hat{i}}, \hat{p}_j] = \hat{i} \hat{\times} \hat{\delta}^i_j, \;\; [\hat{r}^{\hat{i}}, \hat{r}^j] = [\hat{p}_{\hat{i}}, \hat{p}_j] = \hat{0}. \tag{7.40}$$

isonormalization

$$< \hat{\psi} | \hat{\times} | \hat{\psi} > \times \hat{I} = \hat{I}, \tag{7.41}$$

HADRONIC MECHANICS

MECHANICS AND THEIR ISODUALS

Newtonian Mechanics	Isodual Newtonian Mechanics
Hamiltonian mechanics	Isodual Hamiltonian Mechanics
Quantization	Isodual Quantization
Quantum mechanics	Isodual Quantum Mechanics
Special Relativity	Isodual Special Relativity

REPRESENTATION: isolated systems of point-like particles (mechanics) and antiparticles (isodual mechanics) under local, linear and potential forces.

ISOMECHANICS AND THEIR ISODUALS

Iso-Newtonian Mechanics	Isodual iso-Newtonian Mech.
Iso-Hamiltonian mechanics	Isodual iso-Hamiltonian Mech.
Isoquantization	Isodual Isoquantization
Isohadronic mechanics	Isodual isohadronic Mech.
Isospecial Relativity	Isodual Special Relativity

REPRESENTATION: Isolated, reversible and single-valued systems of extended particles (isomechanics) and antiparticles (isodual isomechanics) under internal, local and nonlocal, linear and nonlinear, potential and nonpotential forces.

GENOMECHANICS AND THEIR ISODUALS

Geno-Newtonian Mechanics	Isodual Geno-Newtonian Mech.
Geno-Hamiltonian mechanics	Isodual Geno-Hamiltonian Mech.
Genoquantization	Isodual Genoquantization
Genohadronic mechanics	Isodual Genohadronic Mechanics
Genospecial Relativity	Isodual Genospecial Relativity

REPRESENTATION: open, irreversible and single-valued systems of extended particles (genomechanics) and antiparticles (isodual genomechanics) under external, local and nonlocal, linear and nonlinear, potential and nonpotential forces.

HYPERMECHANICS AND THEIR ISODUALS

Hyper-Newtonian Mechanics	Isodual Hyper-Newtonian Mech.
Hyper-Hamiltonian mechanics	Isodual Hyper-Hamiltonian Mech.
Hyperquantization	Isodual Hyperquantization
Hyperhadronic mechanics	Isodual Hyperhadronic Mech.
Hyperspecial Relativity	Isodual Hyperspecial Relativity

REPRESENTATION: open, irreversible and multi--valued systems of extended particles (hypermechanics) and antiparticles (isodual hypermechanics) under external, local and nonlocal, linear and nonlinear, potential and nonpotential forces.

Figure 15: *Classification of hadronic mechanics into its various classical and operator branches[18].*

isoexpectation values of an iso-Hermitean operator $\hat{A}$

$$\hat{<}\hat{A}\hat{>} =< \hat{\psi}|\hat{\times}\hat{A}\hat{\times}|\hat{\psi} > \times\hat{I} \in \hat{\mathcal{C}}, \tag{7.42}$$

and *isounit identities*

$$\hat{I}\hat{\times}|\hat{\psi} >= |\hat{\psi} >, \quad < \hat{\psi}|\hat{\times}\hat{I}\hat{\times}|\hat{\psi} > \times\hat{I} = \hat{I}. \tag{7.43}$$

assuring that $\hat{I}$ is indeed the correct basic isounit of the theory.

The axiomatically correct formulation of the isotopies of Heisenberg equations, first achieved in Refs. [10,1] following their original proposal (7.31) in memoirs [5], and today called the *Heisenberg-Santilli isoequations*, can be written in their finite form on $\hat{\mathcal{H}}$ over $\hat{\mathcal{C}}$ for the time evolution of a (Hermitean) operator $\hat{A}$

$$\hat{A}(\hat{t}) = \hat{U}(\hat{t})\hat{\times}\hat{A}(\hat{0})\hat{\times}\hat{U}^{\dagger}(\hat{t}) = (\hat{e}^{i\times H\times t})\hat{\times}\hat{A}(\hat{0})\hat{\times}(\hat{e}^{-i\times t\times H}), \tag{7.44}$$

where $\hat{e}$ is the isoexponential, characterizing a one-dimensional *Lie-Santilli isotransformation group,* with corresponding infinitesimal form

$$\hat{i}\hat{\times}\frac{\hat{d}\hat{A}}{\hat{d}\hat{t}} = \hat{A}\hat{\times}\hat{H} - \hat{H}\hat{\times}\hat{A} = [\hat{A},\hat{H}]. \tag{7.45}$$

and fundamental isounitary property

$$\hat{U} = \hat{e}^{i\times H\times t}, \;\; \hat{U}\hat{\times}\hat{U}^{\dagger} = \hat{U}^{\dagger}\hat{\times}\hat{U} = \hat{I}_r. \tag{7.46}$$

that recovers unitarity at the abstract level, a property truly crucial for the achievement of time invariance for the operator representation of NSA interactions (see Section 7.V).

7.IV.5. Practical Realization of the Isotopic Branch of Hadronic Mechanics. The equations (7.38)-(7.43) have been written in their abstract mathematical formulation as necessary for axiomatic consistency. Their practically used version is easily obtained by their *projection* on $\mathcal{H}$ over C with their explicit functional dependence

$$i\hat{I}_t(t,r,p,\omega,\psi,\partial\psi,...)\partial_t|\hat{\psi}(t,r) >=$$

$$= H(r,p)T_r(t,r,p,\omega,\psi,\partial\psi,...)|\hat{\psi}(t,r) >= E|\hat{\psi}(t,r) >, \tag{7.47a}$$

$$p_k T_p(t,r,p,\omega,\psi,\partial\psi,...)|\hat{\psi}(t,r) >=$$

$$= -i\hat{I}_p((t,r,p,\omega,\psi,\partial\psi,...)\partial_k|\hat{\psi}(t,r) >, \tag{7.47b}$$

$$[r^{i}\hat{,}p_j] = i\hat{I}_r\delta^i_j, \;\; [r^{i}\hat{,}r^j] = [p_i\hat{,}p_j] = 0. \tag{7.44c}$$

$$\hat{<}\hat{A}\hat{>} =< \hat{\psi}|TAT|\hat{\psi} > \hat{I}. \tag{7.47d}$$

We also have the following *isoplanewaves,* namely, conventional planewaves experiencing a mutation due to their immersion within the scattering region,

$$\hat{\psi}(r) = \hat{e}^{i\times k\times r} = \hat{I}(e^{iK\hat{T}\times r}), \tag{7.48}$$

with isoeigenvalue equation (assuming for simplicity that the isounit does not depend on coordinates, see Ref. [11b] for the general case.

$$pT\hat{\psi} = -i\hat{I}\partial_r\hat{\psi} = -i^2\hat{I}\hat{T}K\hat{\psi} = K\hat{\psi}, \tag{7.49}$$

Similarly, Eqs. (7.44)-(7.46) have also been written in their abstract formulation because necessary for consistency. Nevertheless, by using exponentiation, they can be written in their projection on $\mathcal{H}$ over $\mathcal{C}$ which is essentially that of Eqs. (7.31) of 1978,

$$A(t) = (e^{iHTt})A(0)(e^{-itTH}), \tag{7.50a}$$

$$i\hat{I}((t,r,p,\omega,\psi,\partial\psi,...)\frac{dA}{dt} =$$
$$= AT((t,r,p,\omega,\psi,\partial\psi,...)H(r,p) - H(r,p)T(t,r,p,\omega,\psi,\partial\psi,...)A =$$
$$= [A\hat{,}H]. \tag{7.50b}$$

The reader can now see the fundamental relevance for hadronic mechanics of the isodifferential calculus because, until achieved, hadronic mechanics had no consistent formulation of the linear momentum, angular momentum, plane waves and other basic features.

We should recall that isotopies preserve Hermiticity to the extent that the operations of Hermiticity and iso-Hermiticity coincide. Hence, all observables of quantum mechanics remain observables for the covering hadronic mechanics. Also, by conception and construction, quantum and hadronic mechanics coincide at the abstract, realization-free level. Therefore, any criticism on the axiomatic structure of hadronic mechanics is indeed a criticism on the axiomatic structure of quantum mechanics.

Additionally, we should also recall that *hadronic mechanics has been conceived and constructed as a kind of completion of quantum mechanics much along the historical Einstein-Podolsky-Rosen argument* (see Ref. [31] on the latter aspects). In this way, *the isoeigenvalue equation (7.38) can be considered to be an explicit and consistent realization of the hidden variables* λ*, although via the isotopic element* $\hat{T}$,

$$H\hat{\times}|\hat{\psi}>= H\lambda|\hat{\psi}>= E|\hat{\psi}>, \;\; \lambda \equiv \hat{T}. \tag{7.51}$$

We should also indicate that the fundamental isounitarity property (7.46), combined with the reconstruction on isospaces over isofields of linearity, have permitted the resolutions of the inconsistencies of Theorem 7.1, by permitting in particular the application to non-linear composite systems that, as indicated earlier are prohibited to quantum mechanics when the Hamiltonian depends on the wavefunctions.

Note that the various "deformations of quantum mechanics" existing in the literature were formulated years following the appearance of the isotopies and genotopies [5] of 1978, and are essentially *identical* to these original formulations on conventional spaces over conventional fields, thus verifying Inconsistency Theorem 7.1.

7.5. SIMPLE CONSTRUCTION AND INVARIANCE OF ISOTOPIC THEORIES: The practical construction of a time invariant non-Hamiltonian theory from a given Hamiltonian form for the case of the so-called *regular isotopies* is quite simple.[26] For this purpose, it is merely sufficient:

1) To represent all non-linear, non-local and non-Hamiltonian interactions with a non-unitary transform,

$$UU^\dagger \neq I \tag{7.52}$$

2) Identify such a non-unitary transforms with the basic isounit,

$$UU^\dagger = \hat{I}, \tag{7.53}$$

3) Apply the above non-unitary transforms to *totality* of the original quantum mechanical formalism,

$$I \to \hat{I} = U\ I\ U^\dagger = 1/\hat{T}, \tag{7.54a}$$

$$n \to \hat{n} = UnU^\dagger = nUU^\dagger = n\hat{I},\ n \in F, \hat{n} \in \hat{F}, \tag{7.54b}$$

$$e^A \to Ue^AU^\dagger = \hat{I}e^{\hat{T}\hat{A}} = (e^{\hat{A}\hat{T}})\hat{I}, \tag{7.54c}$$

$$AB \to U(AB)U^\dagger =$$

$$= (UAU^\dagger)(UU^\dagger)^{-1}(UBU^\dagger) = \hat{A}\hat{\times}\hat{B}, \tag{7.54d}$$

$$[X_i, X_j] \to U[X_iX_j]U^\dagger =$$

$$= [\hat{X}_i\hat{,}\hat{X}_j] = U(C_{ij}^k X_k)U^\dagger = \hat{C}_{ij}^k\hat{\times}\hat{X}_k = C_{ij}^k\hat{X}_k, \tag{7.54e}$$

$$H|\psi > \to U(H|\psi >)U^\dagger = (UHU^\dagger)(UU^\dagger)^{-1}(U|\psi > U^\dagger) =$$

$$= \hat{H}\hat{\times}|\hat{\psi} >, \tag{7.54f}$$

$$< \psi|\ |\psi > \to U < \psi|\ |\psi > U^\dagger =$$

$$=< \psi|U^\dagger(UU^\dagger)^{-1}U|\psi > (UU^\dagger) =$$

$$=< \hat{\psi}|\hat{\times}|\hat{\psi} > \hat{I}, etc. \tag{7.54g}$$

It is easy to see that, once achieved via a non-unitary transform, isotopic theories *are not* invariant under additional non-unitary transforms because of the lack of invariance of the isounit and of the isoproduct. In fact, by introducing the following non-unitary transform,

$$WW^\dagger \neq I, \tag{7.55}$$

[26]The *regular isotopies* are those preserving the original structure constants, while the *irregular isotopies* are those altering the original structure constants. It is evident that the former can be built via simple non-unitary transformations, but this is not possible for the latter.

we have the non-invariance

$$\hat{I} \to \hat{I}' = W\hat{I}W^\dagger \neq \hat{I}, \tag{7.56}'$$

But the isounit represents non-Hamiltonian interactions. Therefore, *the change of the isounit represents the transition from the original physical system to a different system,* e.g., the transition from the structure of a hadron to a high energy collision.

However, non-unitary transforms can be *identically* reformulated as the *isounitary transformations* [24]

$$W = \hat{W}\hat{T}^{1/2}, \tag{7.57a}$$

$$WW^\dagger = \hat{W}\hat{\times}\hat{W}^\dagger = \hat{W}^\dagger\hat{\times}\hat{W} = \hat{I}, \tag{7.57b}$$

under which we achieve the fundamental invariance of the isounit[*loc. cit.*]

$$\hat{I} \to \hat{I}' = \hat{W}\hat{\times}\hat{I}\hat{\times}\hat{W}^\dagger \equiv \hat{I}, \tag{7.58}$$

as well as the equally fundamental invariance of the isoproduct

$$\hat{A}\hat{\times}\hat{B} \to \hat{W}\hat{\times}(\hat{A}\hat{\times}\hat{B})\hat{\times}\hat{W}^\dagger =$$

$$= (\hat{W}\hat{T}\hat{A}\hat{T}\hat{W}^\dagger)(\hat{T}\hat{W}^\dagger)^{-1}\hat{T}(\hat{W}\hat{T})^{-1}(\hat{W}\hat{T}\hat{B}\hat{T}\hat{W}^\dagger) =$$

$$= \hat{A}'(\hat{W}^\dagger\hat{T}\hat{W})^{-1}\hat{B}' = \hat{A}'\hat{T}\hat{B}' = \hat{A}'\hat{\times}\hat{B}', \tag{7.59}$$

with consequential invariance under time evolution of the entire isotopic theory.

8. The Universal Lorentz-Poincaré-Santilli IsoSymmetry.

8.I. FOREWORD.

As it is well known, the Lorentz-Poincaré (LP) symmetry of the Minkowski space $M(x, \eta, I)$ over the field of real numbers $F(n, \times, I)$ with unit $I = Diag.(1, 1, 1, 1)$ and line element

$$(x - y)^2 = (x^\mu - y^\mu)\eta_{\mu\nu}(x^\nu - y^\nu)I =$$

$$= [(x_1 - y_1)^2 + (x_2 - y_2)^2 + (x_3 - y_3)^2 - (t_1 - t_2)^2c^2]I, \tag{8.1}$$

$$\eta = Diag.(1, 1, 1, -c^2),, \quad I = Diag.(1, 1, 1, 1) \tag{8.1b}$$

constitutes the ultimate structural foundations of the Lorentz-Poincaré-Einstein (LPE) special relativity because it permits the unique and unambiguous characterization of its basic axioms and physical laws for exterior problems in vacuum.

Under isotopies, we have exactly the same occurrence, namely, the universal Lorentz-Poincaré-Santilli (LPS) isosymmetry of the Minkowski-Santilli isospace $\hat{M}(\hat{x}, \hat{\eta}, \hat{I})$ over the isoreals $\hat{R}(\hat{n}, \hat{\times}, \hat{I})$ with isounit $\hat{I}$ and all infinitely possible (non-singular) symmetric isoline elements (7.12), i.e.,

$$(\hat{x} - \hat{y})^{\hat{2}} = [(x^\mu - u^\mu)g_{\mu\nu}(x, v, a, E, d, \omega, \tau, \psi, \partial\psi, ...)(x^\nu - y^\nu)]\hat{I} =$$

$$= [\frac{(x_1-y_1)^2}{n_1^2}+\frac{(x_2-y_2)^2}{n_2^2}+\frac{(x_3-y_3)^2}{n_3^2}-\frac{(t_1-t_2)^2c^2}{n_4^2}]\hat{I}, \tag{8.2a}$$

$$g=\hat{T}\eta,\ \ \hat{T}=Diag((\frac{1}{n_1^2},\frac{1}{n_2^2},\frac{1}{n_3^2},\frac{1}{n_4^2}), \tag{8.2b}$$

$$n_\mu=n_\mu(x,v,a,E,d,\omega,\tau,\psi,\partial\psi,...)>0,\ \mu=1,2,3,4, \tag{8.2c}$$

constitutes the ultimate foundations of the covering IsoRelativity for interior dynamical problems within physical media. For this reason, no serious knowledge of isoRelativity can be claimed without at least some knowledge of the LPS isosymmetry, thus suggesting its review in this section for minimal self sufficiency of this paper.

As recalled earlier, the achievement of the LPS isosymmetry required decades of solitary studies by the author, since there was first the need to construct the isotopies of Lie's theory [5a,11a], and then the isotopies of each and every aspect of the LP symmetry, including the isotopies of: the rotational symmetry [25]; the Lorentz symmetry in its classical [3] and operator [26] forms; the SU(2) spin symmetry [27]; the Poincaré symmetry [28]; the spinorial covering of the Poincaré symmetry [29]; the Minkowskian geometry [30]; local realism, Bell's inequality, hidden variables and all that [31] (see monograph [11b] for the most comprehensive presentation to date).

8.II. BASIC DEFINITIONS.

Via the use of the Lie-Santilli isotheory, the transformations leaving invariant isoseparation (8.2a) can be written in the following form [3] (where we shall preserve in this section the symbol $\times$ for the conventional associative product for comparison with its isotopic covering)

$$\hat{x}'=\hat{\Lambda}(\hat{w})\hat{\times}\hat{x},\ \ \hat{x}'=\hat{x}+\hat{A}(\hat{x},...), \tag{8.3a}$$

$$\hat{\Lambda}^\dagger\hat{\times}\hat{\eta}\hat{\times}\hat{\Lambda}=\Lambda\times\hat{\eta}\times\Lambda^\dagger=\hat{I}\times\hat{\eta}\times\hat{I}, \tag{8.3b}$$

under the isomodularity condition

$$\hat{Det}\ (\hat{\Lambda})=\pm\hat{I}, \tag{8.4}$$

where the quantity $\hat{A}$ is identified below and $\hat{w}=w\times\hat{I}$ represents the isoparameters.

The isoconnected component $\hat{P}^0(3.1)$ of the isosymmetry is then characterized by

$$\hat{Det}\ \hat{\Lambda}=+\hat{I}, \tag{8.5a}$$

$$\hat{P}^0(3.1)=\hat{SO}(3.)\times\hat{\mathcal{T}}(3.1)\times\hat{\mathcal{D}}, \tag{8.5b}$$

where $\hat{\mathcal{D}}$ is the 11th symmetry of Theorem 7.2, Eqs. (7.15), with explicit form of the *regular, finite, isotransforms* expressed in terms of the isoexponentiation [3]

$$\hat{SO}(3.1):\ \ \hat{x}'=\left(\hat{e}^{i\times J_k\times w_k}\right)\hat{\times}\hat{x}\hat{\times}\left(\hat{e}^{-i\times J_k\times w_k}\right)=$$

$$=[\left(e^{i\times J_k\times\hat{T}\times w_k}\right)\times x\times\left(e^{-i\times w_k\times\hat{T}\times J_k}\right)]\times\hat{I}, \tag{8.6a}$$

$$\hat{A}(3.1): \quad \hat{x}' = \left(\hat{e}^{i\times P_\mu \times a_\mu}\right) \hat{\times} \hat{x} \hat{\times} \left(\hat{e}^{-i\times P_\mu \times a_\mu}\right) =$$
$$= \left[\left(e^{i\times P_\mu \times \hat{T} \times a_\mu}\right) \times x \times \left(e^{-i\times a_\mu \times \hat{T} \times P_\mu}\right)\right] \times \hat{I}, \tag{8.6b}$$

where $(J_k) = (J_{\mu\nu}),\ P_\mu,\ w_k, a_\mu, k = 1,2,3,4,5,6,\ \mu,\nu = 1,2,3,4$, are conventional quantities of the LP symmetry.

The reader should definition the very definition of the isotopies of a Lie symmetry in which the generators are left unchanged (as a necessary condition to preserve the conventional conservation laws), and only their operations are lifted.

An inspection of the above basic rules then proves the following:

THEOREM 8.1 [11b]: Given a Lie symmetry S of a the line element of an n-dimensional metric space $M(x,\eta,1)$ with metric η, the isotopies $\hat{S}$ of S characterized by the sole knowledge of the $n \times n$, positive-definite, isotopic element $\hat{T}$ leave invariant the isoline element with mutated metric $g = \hat{T}\eta$, and all infinitely possible hat$S$ so constructed are isomorphic to the original symmetry S.

8.III. ISOALGEBRA OF THE LPS ISOSYMMETRY.

By expanding the preceding finite isotransforms in terms of the isounit, the *regular LPS isoalgebra* is characterized by the conventional generators of the LP algebra and the isocommutation rules [3,28]

$$[J_{\mu\nu}\hat{,}J_{\alpha\beta}] = i \times (\hat{\eta}_{\nu\alpha} \times J_{\beta\mu} - \hat{\eta}_{\mu\alpha} \times J_{\beta\nu} - \hat{\eta}_{\nu\beta} \times J_{\alpha\mu} + \hat{\eta}_{\mu\beta} \times J_{\alpha\nu}), \tag{8.7a}$$

$$[J_{\mu\nu}\hat{,}P_\alpha] = i \times (\hat{\eta}_{\mu\alpha} \times P_\nu - \hat{\eta}_{\nu\alpha} \times P_\mu), \tag{8.7b}$$

$$[P_\mu\hat{,}P_\nu] = 0. \tag{8.7c}$$

The *iso-Casimir invariants* of $\hat{P}(3.1)$ are given by [*loc. cit*]

$$\hat{C}_1 = \hat{I}(x,...), \tag{8.8a}$$

$$\hat{C}_2 = P^{\hat{2}} = P_\mu \hat{\times} P^\mu = P^\mu \times \hat{\eta}_{\mu\nu} \times P^\nu =$$
$$= P_k \times g_{kk} \times P_k - p_4 \times g_{44} \times P_4, \tag{8.8b}$$

$$\hat{C}_3 = W^{\hat{2}} = W_\mu \hat{\times} W^\mu, \ \ W_\mu = \hat{\epsilon}_{\mu\alpha\beta\rho} \hat{\times} J^{\alpha\beta} \hat{\times} P^\rho, \tag{8.8c}$$

and they are at the foundation of classical and operator *isorelativistic kinematics* [11b].

Since $\hat{I} > 0$, the mutated metric $\hat{\eta}$ has the same signature $(+,+,+,-)$ of η and, therefore, it is easy to prove that *the LPS isosymmetry is isomorphic to the conventional symmetry (Theorem 8.1).* It then follows that the isotopies increase dramatically the arena of applicability of the LP (as well as well as any Lie) symmetry, by lifting the Minkowskian spacetime (8.1) to all infinitely possible isospacetime (8.2).

To prevent easily predictable rapid conclusion of triviality due to lack of technical understanding, the reader should note that *the linear momenta isocommute, Eqs. (8.8.7c), but they do not generally commute when projected in the ordinary Minkowski space.* This occurrence is a clear manifestation of a nonlinear structure with rather deep implications, such

as the reformulation of the Riemannian geometry in terms of the iso-Minkowskian geometry [30], consequential, axiomatically consistent grand unification and operator forms of gravity including antimatter [20], and other intriguing advances.

The *irregular LPS isoalgebra* is characterized by *structure functions* [11b], thus being different than those of the LP symmetry. As such, it is not considered here for brevity.

8.IV. ISOTRANSFORMATIONS OF THE LPS ISOSYMMETRY.
By using the original generators of the LP symmetry, the isotopic element (8.2b) and Lie-Santilli isogroup (8.6), we have the following explicit form of the LPS isotransformations in their projection in our spacetime, their formal expression on isospaces over isofields being trivial:

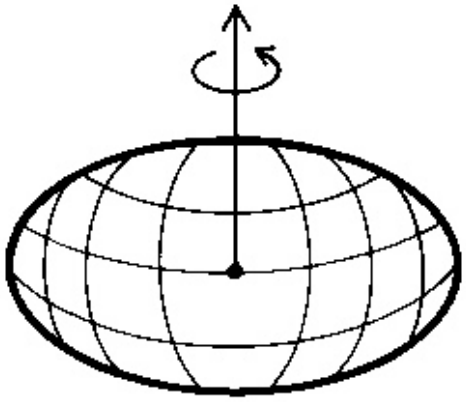

Figure 16: *It was popularly believed in the 20th century physics that the rotational symmetry is violated for ellipsoids. Santilli isosymmetries have restored the exact validity of the rotational symmetry for all possible (topology preserving) deformations of the sphere, by setting up in this way the foundations for maintaining the abstract axioms of special relativity for interior dynamical problems [25].*

8.1) **Regular isorotations** $\hat{SO}(3)$, first presented in Ref. [26], here expressed for simplicity in the (1,2)-plane (see monograph [11b] for the general case)

$$x^{1'} = x^1 \times \cos[\theta \times (n_1 \times n_2)^{-1}] - x^2 \times \frac{n_1^2}{n_2^2} \times \times \sin[\theta \times (n_1 \times n_2)^{-1}], \qquad (8.9a)$$

$$x^{2'} = x^1 \times \frac{n_2^2}{n_1^2} \times \sin[\theta \times (n_1 \times n_2)^{-1}] + x^2 \times \cos[\theta \times (n_1 \times n_2)^{-1}], \qquad (8.9b)$$

It was popularly believed in the 20th century that the $SO(3)$ symmetry is broken for the ellipsoid deformations of the sphere. However, it is easy to prove that $\hat{SO}(3)$ is isomorphic to $SO(3)$, e.g., because in the transition from a Lie symmetry to its regular isotopic covering, the original generators, parameters and structure constants remain unchanged,

thus allowing the *isotopic reconstruction of the exact rotational symmetry for all possible ellipsoidal deformations of the sphere.*

Conceptually, this is due to the fact that ellipsoid deformations of the semiaxes of the perfect sphere are compensated on isospaces over isofields by the *inverse* deformation of the related unit

$$Radius \quad 1_k \to 1/n_k^2, \;\; Unit \quad 1_k \to n_k^2. \tag{8.10}$$

resulting in the reconstruction of the perfect sphere on isospace called the *isosphere*,

$$\hat{r}^{\hat{2}} = \hat{r}_1^{\hat{2}} + \hat{r}_2^{\hat{2}} + \hat{r}_3^{\hat{2}}. \tag{8.11}$$

with consequential reconstruction of the exact rotational symmetry.

8.2) **Regular Lorentz-Santilli isotransforms** $\hat{SO}(3.1)$, first identified in Ref. [3] in the form (5.5), here presented in a symmetrized form, for simplicity, in the (3-4)-plane (see monograph [11b] for the general case)

$$x^{1'} = x^1, \;\; x^{2'} = x^2, \tag{8.12a}$$

$$x^{3'} = \hat{\gamma} \times (x^3 - \hat{\beta} \times \frac{n_3}{n_4} \times x^4), \tag{8.12b}$$

$$x^{4'} = \hat{\gamma} \times (x^4 - \hat{\beta} \times \frac{n_4}{n_3} \times x^3), \tag{8.12c}$$

where

$$\hat{\beta} = \frac{v_3/n_3}{c_o/n_4}, \;\; \hat{\gamma} = \frac{1}{\sqrt{1 - \hat{\beta}^2}}. \tag{8.13}$$

Again, it was popularly believed in the 20th century that the Lorentz symmetry is broken for deformations of the light cone. By contrast, Ref. [37] proved that the Lorentz symmetry does remain exact under the deformations of the light cone, provided it is treated with the appropriate mathematics. This result was achieved via the proof of the local isomorphism between $\hat{SO}(3.1)$ and $SO(3.1)$.

Conceptually, this is due to the reconstruction of the exact light cone on isospace over isofields called the *light isocone*. In fact, jointly with the deformation of the light cone

$$x^2 = x_3^2 - t^2 \times c^2 = 0 \to \frac{x_3^2}{n_3^2} - t^2 \times \frac{c^2}{n^4} = 0, \tag{8.14}$$

we have the corresponding *inverse* deformations of the units, thus reconstructing the original light cone on isospaces over isofields,

$$\hat{x}^{\hat{2}} = \hat{x}_3^{\hat{2}} - \hat{t}^{\hat{2}} \times \hat{c}^{\hat{2}} = 0. \tag{8.15}$$

The reader should be aware that the above reconstruction includes the preservation on isospace over isofields of the original characteristic angle of the conventional light cone,

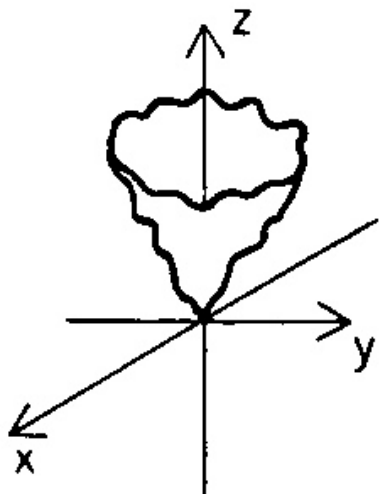

Figure 17: *It was popularly believed in the 20th century physics that the Lorentz symmetry is violated for locally varying speeds of light (here represented with a wiggly light). Santilli isosymmetries have restored the exact validity of the Lorentz symmetry for all possible subluminal and superluminal speeds, thus confirming the preservation of the abstract axioms of special relativity for interior dynamical problems [3,4,28].*

namely, *the maximal causal speed on isospace over isofields is the conventional speed of light c in vacuum.*

8.3) **Regular isotranslations** $\hat{\mathcal{T}}(4)$, first studied in ref. [28] (see monograph [11b] for the general case) can be expressed with the following lifting of the conventional translations $x^{\mu'} = x^\mu + a^\mu, \mu = 1, 2, 3, 4,$ and a^μ constants,

$$x^{\mu'} = x^\mu + A^\mu(a, \ldots), \tag{8.16}$$

where

$$A^\mu = a^\mu(n_\mu^{-2} + a^\alpha \times [n_\mu^{-2}\hat{,}P_\alpha]/1! + \ldots), \tag{8.17}$$

and there is no summation on the μ indices.

8.4) **Regular isodilations** $\hat{\mathcal{D}}(1)$, first identified in Ref. [28] (see, again, monograph [11b] for the general case)

$$\hat{\eta} \to \hat{\eta}' = w^{-1} \times \hat{\eta},\ \hat{I} \to \hat{I}' = w \times \hat{I}, \tag{8.18a}$$

$$(x^\mu \times \hat{\eta}_{\mu\nu} \times x^\nu) \times \hat{I} \equiv [x^\mu \times (w^{-1}\hat{\eta}_{\mu\nu}) \times x^\nu) \times (w \times \hat{I}) =$$
$$= (x^\mu \times \hat{\eta}'_{\mu\nu} \times x^\nu) \times \hat{I}',\ w \in \mathcal{R}. \tag{8.18b}$$

from which, as the reader may recall, Theorem 7.2 follows. Hence, *the LPS isosymmetry is eleven dimensional exactly as it is the case for the LP symmetry.*

8.5) **Regular isoinversions** [28,11b]

$$\hat{\pi}\hat{\times}x = \pi x = (-r, tc), \tag{8.19a}$$

$$\hat{\tau}\hat{\times}x = \tau x = (r, -tc_{.} \tag{8.19b}$$

where π and τ are the conventional space and time inversion operators.

8.V. ISOSPINORIAL LPS ISOSYMMETRY.
Recall that the spinorial covering of the LP symmetry can be explicitly constructed via the conventional Dirac equations

$$(\eta^{\mu\nu} \times \gamma_\mu \times P_\nu + i \times m) \times |\psi >= 0. \tag{8.20}$$

and expressed in terms of the familiar Dirac matrices

$$\gamma^k = \begin{pmatrix} 0 & \sigma_k \\ -\sigma_k & 0 \end{pmatrix}, \ \gamma^4 = i \times \begin{pmatrix} I_{2\times 2} & 0 \\ 0 & -I_{2\times 2} \end{pmatrix}. \tag{8.21}$$

recall also that the Dirac equation is obtained via the linearization of the second order conventional Casimir invariant of the LP symmetry.

The isotopies of the above setting were constructed in ref. [29] as follows. To begin, recent studies of the conventional Dirac equation have identified its structure as the direct product of a spin 1/2 particle characterized by the Pauli matrices σ_k and the positive-definite unit $I_{2\times 2}$ and a spin 1/2 antiparticle characterized by the isodual Pauli matrices $\sigma_k^d = -\sigma_k^\dagger = -\sigma_k$ and the negative-definite isodual unit $I_{2\times 2}^d = -I_{2\times 2}^\dagger = -I_{2\times 2}$ [20], with resulting total carrier space

$$S_{tot} = \{M_{orb}(x, \eta, R) \times S_{spin}(2)\} \times \{M_{orb}^d(x^d, \eta^d, R^d) \times S_{spin}^d(2)\}, \tag{8.22}$$

that resulted in being *twelve-dimensional,* due to the inclusion of the orbital and intrinsic spaces for both the particle and its antiparticle.

Consequently, the author assumed in Ref. [29] the following twelve-dimensional, total isospace for the isotopies of the Dirac equations

$$\hat{S}_{tot} = \{\hat{M}_{orb}(\hat{x}, \hat{\eta}, \hat{R}) \times \hat{S}_{spin}(2)\} \times \{\hat{M}_{orb}^d(\hat{x}^d, \hat{\eta}^d, \hat{R}^d) \times \hat{S}_{spin}^d(2)\}. \tag{8.23}$$

The isotopies of the above structure requires the use of *four different isounits and related isotopic elements,* for each of the four distinct motions,

$$\hat{I}_{tot} = \{\hat{I}_{orb} \times \hat{I}_{spin}\} \times \{\hat{I}_{orb}^d \times \hat{I}_{spin}^d\}. \tag{8.24a}$$

$$\hat{T}_{tot} = \{\hat{T}_{orb} \times \hat{T}_{spin}\} \times \{\hat{T}_{orb}^d \times \hat{T}_{spin}^d\}, \tag{8.24b}$$

with combined total orbital (to) and total spin (ts) expressions for particle and antiparticle

$$\hat{I}_{to} = \hat{I}_{orb} \times \hat{I}_{orb}^d, \ \ \hat{I}_{ts} = \hat{I}_{spin} \times \hat{I}_{spin}^d \tag{8.25}$$

To avoid an excessive complexity, we here ignore antiparticles and assume that there is no mutation of spin under these restrictions, the linearization of the second order iso-Casimir invariant (8.8b) led to the expressions

$$(\hat{G}^{\mu\nu}\hat{\times}_{to}\hat{P}_\mu\hat{\times}_{to}\hat{P}_\nu+\bar{m}_{\hat{e}}^2)\hat{\times}_{to}|\hat{\psi}>=$$

$$=(\hat{G}^{\mu\nu}\hat{\times}_{to}\hat{\Gamma}_\mu\hat{\times}_{to}\hat{P}_\nu+\hat{i}\hat{\times}_{to}\bar{m}_{\hat{e}})\hat{\times}_{to}(\hat{G}^{\alpha\beta}\hat{\times}_{to}\hat{\Gamma}_\alpha\hat{\times}_{to}\hat{P}_\beta+\hat{i}\hat{\times}_{to}\bar{m}_{\hat{e}})\hat{\times}_{to}|\hat{\psi}>=0, \tag{8.26a}$$

$$\{\hat{\Gamma}_\mu,\hat{\Gamma}_\nu\}=\hat{\Gamma}_\mu\hat{\times}_{to}\hat{\Gamma}_\nu+\hat{\Gamma}_\nu\hat{\times}_{to}\hat{\Gamma}_\mu=\hat{2}\hat{\times}_{to}\hat{G}_{mu\nu}, \tag{8.26b}$$

$$\{\hat{\gamma}_\mu,\hat{\gamma}_\nu\}=\hat{\gamma}_\mu\times\hat{T}\times\hat{\gamma}_\nu+\hat{\gamma}_\nu\times\hat{T}\times\hat{\gamma}_\mu=2\times\hat{\eta}_{\mu\nu}, \tag{6.8.26c}$$

$$\hat{\Gamma}_\mu=\hat{\gamma}_\mu\times\hat{I}_{to}. \tag{8.26d}$$

The above expressions then led the desired isotopies of Dirac equations, today known as the *Dirac-Santilli isoequation,* first derived in ref. [29] of 1995 when the author was visiting the *Joint Institute for Nuclear Research* in Dubna, Russia (following several inconsistent preceding attempts by the author and other researchers here ignored)

$$(\hat{G}^{\mu\nu}\hat{\times}\hat{\Gamma}_\mu\hat{\times}\hat{P}_\nu+\hat{i}\hat{\times}\bar{m}c)\hat{\times}|\hat{\psi}>=(\hat{\eta}^{\mu\nu}\times\hat{\gamma}_\mu\times\hat{P}_\nu+i\times\bar{m}c)\times\hat{T}\times|\hat{\psi}>=0. \tag{8.27}$$

where the $\hat{\gamma}_\mu$ are called the *Dirac-Santilli isomatrices* with explicit form

$$\hat{\gamma}_k=\frac{1}{n_k}\times\begin{pmatrix}0&\hat{\sigma}_k\\ \hat{\sigma}_k^d&0\end{pmatrix},\ \ \hat{\gamma}_4=i\times\frac{1}{n_4}\times\begin{pmatrix}I_{2\times2}&0\\0&I_{2\times2}^d\end{pmatrix}, \tag{8.28}$$

and

$$\bar{m}=m\times\frac{n_3}{n_4}. \tag{8.29}$$

The first construction of the *isospinorial LPS isosymmetry* is then given by [29]

$$\hat{\mathcal{P}}(3.1)=\hat{SL}(2.\hat{C})\times\hat{\mathcal{T}}(3.1)\times\hat{\mathcal{D}}, \tag{8.30}$$

with the following realization

$$\hat{SL}(2.\hat{C}):\ \ \hat{R}_k=\frac{1}{2}\times\epsilon_{kij}\Gamma_i\hat{\times}\Gamma_j,\ \ \hat{S}_k=\frac{1}{2}\times\Gamma_k\hat{\times}\Gamma_4, \tag{8.31a}$$

$$\hat{\mathcal{A}}(3.1):\ \ P_\mu. \tag{8.31b}$$

The verification by the above generators of isocommutation rules (8.7) is an instructive exercise for the interested reader. The proof that the Dirac-Santilli isoequation transforms covariance under $\hat{\mathcal{P}}(3.1)$ is instructive. Equally instructive is the proof of the isoselfduality of Eq. (8.27), i.e., invariance under anti-Hermiticity, thus eliminating the need for the representation of antiparticles via second quantization [20].

Particularly intriguing is the following explicit expression of the *hadronic angular momentum,* namely, the angular momentum of a particle originally with spin 1/2 in vacuum,

when immersed within the medium inside hadrons, nuclei and stars, first derived in Ref. [29] (see again monograph [11b] for detailed treatment)

$$\hat{O}(3): \quad \hat{L}_k = \epsilon_{kij}\hat{r}_i\hat{\times}\hat{P}_j, \quad \hat{S}_k = \frac{1}{2} \times \epsilon_{kij}\hat{\gamma}_i\hat{\times}\hat{\gamma}_j, \tag{8.32a}$$

$$[\hat{L}_i\hat{,}\hat{L}_j] = \epsilon_{ijk}n_k^2 \times \hat{L}_k, \tag{8.32b}$$

with eigenvalues

$$\hat{L}^{\hat{2}}\hat{\times}|\hat{\psi}>= (n_1^2 \times n_2^2 + n_2^2 \times n_3^2 + n_3^2 \times n_1^2) \times |\hat{\psi}>, \tag{8.33a}$$

$$\hat{L}_3\hat{\times}|\hat{\psi}>= \pm n_1 \times n_2 \times |\hat{\psi}>, \tag{8.33b}$$

To appraise the physical value of the above expressions, the reader should be aware that they are fundamental for a quantitative representation of *all* characteristics of the neutron in its synthesis from a hydrogen atom inside a star (see Section 11 for details)

$$H - atom \to n \tag{8.34}$$

In fact, isoeigenvalues (8.33) allow the achievement of the numerical value $1/2$ for the *orbital* angular momentum of the electron when immersed inside the proton

$$n_k = \frac{1}{2}, \tag{8.35a}$$

$$\hat{L}^{\hat{2}}\hat{\times}|\hat{\psi}>= 3 \times |\hat{\psi}>, \quad \hat{L}_3\hat{\times}|\hat{\psi}>= \pm\frac{1}{\sqrt{2}} \times |\hat{\psi}>, \tag{8.35b}$$

thus resolving the historical open problem on the synthesis of the neutron.

It is intriguing to recall that *fractional angular momenta are anathema for quantum mechanics because they violate causality and other physical laws. By contrast, fractional as well as non integer values verify all physical laws for the covering hadronic mechanics due to the use of the covering Hilbert-Myung-Santilli isospace over isofields.*

8.VI. REGULAR $\hat{SU}(2)$ ISOSYMMETRY.

In the preceding subsection, we have assumed for simplicity no mutation of the spin of particles in interior conditions. However, the spin is a truly fundamental notion for all mechanics. Therefore, it is essential for minimal self-sufficiency to outline the novel notion of *hadronic spin,* namely, the notion of spin of a particle when immersed within the hyperdense medium inside hadrons as described by hadronic mechanics, is characterized by the irreducible isounitary representation of the isotopies $\hat{SU}(2)$ of the $SU(2)$ spin algebra of quantum mechanics (see monographs [11] for detailed studies).

In this section we shall outline the *regular hadronic spin* whose spectrum is identical to the conventional one. As we shall see in Section 11, this is the case, for instance, for the electron immersed inside the hyperdense medium inside the proton during the neutron synthesis, thus warranting a short review.

By remembering the lack of uniqueness of the isounits and related isotopic element, the simplest regular two-dimensional irreducible isorepresentations of $\hat{SU}(2)$ are characterized by the lifting of the two-dimensional complex-valued unitary space with metric $\delta = Diag.(1.1)$ into the isotopic image [27,31]

$$\hat{I} = Diag.((n_1^2, n_2^2),\ \hat{T} = Diag.(1/n_1^2, 1/n_2^2), \tag{8.36a}$$

$$\hat{\delta} = \hat{T} \times \delta = Diag.(1/n_1^2, 1/n_2^2), \tag{8.36b}$$

$$Det\ \hat{\delta} = (n_1 \times n_2)^{-2} = 1, \tag{8.32c}$$

with corresponding isounit and isotopic element

$$U \times U^\dagger = \hat{I} = \begin{pmatrix} n_1^2 & 0 \\ 0 & n_2^2 \end{pmatrix},\ T = \begin{pmatrix} n_1^{-2} & 0 \\ 0 & n_2^{-2} \end{pmatrix}. \tag{8.37}$$

The related lifting of Pauli's matrices can then be easily constructed via the methods of Section 1.7 as follows

$$\sigma_k\ \rightarrow\ \hat{\sigma}_k = U \times \sigma_k \times U^\dagger, \tag{8.38a}$$

$$U = \begin{pmatrix} i \times n_1 & 0 \\ 0 & i \times n_2 \end{pmatrix}, U^\dagger = \begin{pmatrix} -i \times n_1 & 0 \\ 0 & -i \times n_2 \end{pmatrix}, [10pt] \tag{8.38b}$$

where the n's are well behaved nowhere null functions, resulting in the *regular Pauli-Santilli isomatrices* [*loc. cit*]

$$\hat{\sigma}_1 = \begin{pmatrix} 0 & n_1^2 \\ n_2^2 & 0 \end{pmatrix},\ \hat{\sigma}_2 = \begin{pmatrix} 0 & -i \times n_1^2 \\ i \times n_2^2 & 0 \end{pmatrix},\ \hat{\sigma}_3 = \begin{pmatrix} n_1^2 & 0 \\ 0 & n_2^2 \end{pmatrix}. \tag{8.39}$$

Another realization of the regular hadronic spin 1/2 is given by *non diagonal* nonunitary transforms [*loc. cit.*],

$$\begin{aligned} U &= \begin{pmatrix} 0 & n_1 \\ n_2 & 0 \end{pmatrix},\quad U^\dagger = \begin{pmatrix} 0 & n_2 \\ n_1 & 0 \end{pmatrix}, \\ \hat{I} &= \begin{pmatrix} n_1^2 & 0 \\ 0 & n_2^2 \end{pmatrix},\quad \hat{T} = \begin{pmatrix} n_1^{-2} & 0 \\ 0 & n_2^{-2} \end{pmatrix}, \end{aligned} \tag{8.40}$$

with corresponding alternative version of the regular Pauli-Santilli isomatrices,

$$\hat{\sigma}_1 = \begin{pmatrix} 0 & n_1 \times n_2 \\ n_1 \times n_2 & 0 \end{pmatrix},\ \hat{\sigma}_2 = \begin{pmatrix} 0 & -i \times n_1 \times n_2 \\ i \times n_1 \times n_2 & 0 \end{pmatrix},$$

$$\hat{\sigma}_3 = \begin{pmatrix} n_1^2 & 0 \\ 0 & n_2^2 \end{pmatrix}, \tag{8.41}$$

or by more general realizations with Hermitean non diagonal isounits $\hat{I}$ [15b].

All Pauli-Santilli isomatrices of the above regular class verify the following *isocommutation rules and isoeigenvalue equations* on $\hat{\mathcal{H}}$ over $\hat{\mathcal{C}}$

$$[\hat{\sigma}_i,\hat{\hat{\sigma}}_j] = \hat{\sigma}_i \times \hat{T} \times \hat{\sigma}_j - \hat{\sigma}_j \times \hat{T} \times \hat{\sigma}_i = 2 \times i \times \varepsilon_{ijk} \times \hat{\sigma}_k, \tag{8.42a}$$

$$\hat{\hat{\sigma}}^2 \hat{\times} |\hat{\psi}\rangle =$$

$$(\hat{\sigma}_1 \times T \times \hat{\sigma}_1 + \hat{\sigma}_2 \times T \times \hat{\sigma}_2 + \hat{\sigma}_3 \times T \times \hat{\sigma}_3) \times T \times |\hat{\psi}\rangle = 3 \times |\hat{\psi}\rangle, \tag{8.42b}$$

$$\hat{\sigma}_3 \hat{\times} |\hat{\psi}\rangle = \hat{\sigma}_3 \times T \times |\hat{\psi}\rangle = \pm 1 \times |\hat{\psi}\rangle, \tag{8.42c}$$

thus preserving conventional structure constants and eigenvalues for spin $1/2$ under non-Hamiltonian/nonunitary interactions.

An interesting interpretation has been proposed in Ref. [31] for the case

$$n_1^2 = \lambda, \;\; n_2^2 = \lambda^{-1}, \tag{8.43}$$

according to which *the Pauli-Santilli isomatrices provide an explicit and concrete realization of the true hidden variable,* in the sense that the variable λ is indeed hidden in the axioms of the $SU(2)$ symmetry, with the understanding that we are not referring to the traditional interpretation of hidden variables, such as the historical one by Bohm. Note that this new degree of freedom is absent in the conventional Lie theory and can be solely identified via the Lie-Santilli isotheory.

Irrespective of the type of hidden variable we are here referring to, the regular Pauli-Santilli isomatrices have permitted the reconstruction of the exact isospin symmetry in nuclear physics (popularly believed to be broken by electromagnetic interactions), as well as caused a reinspection of Bell's inequalities, local realism and all that due to the strictly unitary structure of the latter compared to the nonunitary character of the former. We regret being unable to outline these intriguing new vistas, and refer the interested reader to paper [31].

8.VII. IRREGULAR $\hat{SU}(2)$ ISOSYMMETRY.

There is a widespread belief in contemporary physics that the electron, when in the core of a star or inside a black hole, while experiencing pressures beyond our imagination, must have the same spin $1/2$ when orbiting in vacuum around the proton. Since such a belief has no mathematical, physical or experimental credibility, it is a political posture.

The serious scientific issue is that of studying the most general possible covering of the quantum mechanical spin, and then reach conclusions based on future direct experimental evidence. This task is studied in this paper via the notion of *irregular hadronic spin,* namely, the spin characterized by irregular irreducible isounitary representation of the $\hat{SU}(2)$ isosymmetry that, expectedly, characterize a *locally varying* spin depending on the local physical conditions.

One illustrative example of *irregular Pauli-Santilli isomatrices* is given by [27,31]

$$\tilde{\sigma}_1 = \begin{pmatrix} 0 & n_1^2 \\ n_2^2 & 0 \end{pmatrix}, \;\; \tilde{\sigma}_2 = \begin{pmatrix} 0 & -i \times n_1^2 \\ i \times n_2^2 & 0 \end{pmatrix}, \;\; \tilde{\sigma}_3 = \begin{pmatrix} w \times n_1^2 & 0 \\ 0 & w \times n_2^2 \end{pmatrix}. \tag{8.44}$$

where w is the *mutation parameter,* with isocommutation rules and eigenvalue equations

$$[\tilde{\sigma}_1,\tilde{\sigma}_2] = i \times w^{-1} \times \tilde{\sigma}_3, \;\; [\tilde{\sigma}_2,\tilde{\sigma}_3] = i \times w \times \tilde{\sigma}_1, \;\; [\tilde{\sigma}_3,\tilde{\sigma}_2] = i \times w \times \tilde{\sigma}_1, \tag{8.45a}$$

$$\hat{\tilde{\sigma}^2}\hat{\times}|\hat{\psi}\rangle =$$

$$(\tilde{\sigma}_1 \times T \times \tilde{\sigma}_1 + \tilde{\sigma}_2 \times T \times \tilde{\sigma}_2 + \tilde{\sigma}_3 \times T \times \tilde{\sigma}_3) \times T \times |\hat{\psi}\rangle = (2 + w^2) \times |\hat{\psi}\rangle, \tag{8.45b}$$

$$\tilde{\sigma}_3 \hat{\times} |\hat{\psi}\rangle = \tilde{\sigma}_3 \times T \times |\hat{\psi}\rangle = \pm w \times |\hat{\psi}\rangle, \;\; w \neq 1, \tag{8.45c}$$

Additional examples of irregular Pauli-Santilli isomatrices can be found in Refs. [11].

The assumption of a mutated spin in hyperdense interior conditions evidently implies the inapplicability (rather than the violation) of the Fermi-Dirac statistics, Pauli's exclusion principle and other quantum mechanical laws, with the understanding that, by central assumption, non-Hamiltonian bound states of particles as a whole must have conventional total quantum values. Therefore, *we are here referring to possible internal exchanges of angular momentum and spin always in such a way as to cancel out and yield total conventional values.*

9. Mathematical Formulation of IsoRelativity.

Isorelativity can be defined as the ensemble of all infinitely possible generalizations of special relativity for all possible interior dynamical conditions of particles and electromagnetic waves propagating within physical media under the condition of preserving the abstract axioms by Lorentz, Poincaré and Einstein via its formulation in the Minkowski-Santilli isospace with universal isoinvariant (8.2).

As indicated earlier isorelativity was first formulated by the author in paper [3] of 1983, received its first systematic presentation in monographs [4] of 1991, and achieved maturity of formulation, interpretation and verification only following the laborious and solitary journey reviewed in the preceding sections and related references.

As it is well known, the central part of special relativity is constituted by its familiar Axioms 2.I - 2.V that are uniquely and unambiguously identified by the fundamental Lorentz-Poincaré (LP) symmetry. Along exactly the same lines, the isoaxioms of the covering isorelativity are uniquely and unambiguously identified by the Lorentz-Poincaré-Santilli (LPS) isosymmetry outlined in the preceding section, they were first identified in monograph [4b] and can be presented as follows (for all speeds along the third axis):

9A. ISOACIOMS FOR LINEAR MOTIONS.

ISOAXIOM 9.I: The maximal causal speed within physical media is given by

$$\hat{V}_{max} = c\frac{n_3}{n_4} = Cn_3, \;\; C = \frac{c}{n_4}. \tag{9.1}$$

ISOAXIOM 9.II: The addition of speeds within physical media r follows the isotopic law

$$V_{tot} = \frac{v_1 + v_2}{1 + \frac{v_1 v_2}{c^2}\frac{n_4^2}{n_3^2}}. \tag{9.2}$$

ISOAXIOM I9.II: The dilation of time, the contraction of lengths and the variation of mass with speed within physical media follow the isotopic laws

$$t' = \hat{\gamma}\, t, \tag{9.3a}$$

$$\ell' = \hat{\gamma}^{-1}\, \ell, \tag{9.3b}$$

$$m' = \hat{\gamma}\, m, \tag{9.3c}$$

$$\hat{\beta} = \frac{v_3/n_3}{c_o/n_4},\ \ \hat{\gamma} = \frac{1}{\sqrt{1 - \hat{\beta}^2}}. \tag{9.3d}$$

ISOAXIOM 9.IV: The frequency shift within physical media follows the isotopic law

$$\omega' = \hat{\gamma}\, [1 - \hat{\beta}\, cos(\hat{\alpha})]\, \omega, \tag{9.4}$$

ISOAXIOM 9.V: The mass-energy equivalence within physical media follows the isotopic law

$$\hat{E} = m\, V_{max}^2 = m_s c^2 \frac{n_s^2}{n_4^2} = \bar{m}_s c^2. \tag{9.5a}$$

$$\bar{m}_s = m_s \frac{n_s^2}{n_4^2} \tag{9.5b}$$

where s is the space direction in which the isoequivalence is studied.

A few comments are now in order. It should be stressed that, at the pure mathematical level, e.g., when formulated on the Minkowski-Santilli isospace over isofields, the above isoaxioms coincide with conventional axioms. Consequently, *the Lorentz, Poincaré and Einstein axioms are preserved everywhere, that is, in vacuum as well as within physical media, and merely subjected to different realizations for different conditions.*

Interested readers are then suggested to inspect the proof o"direct universality" of Isoaxioms 9.I - 9.V by the author [32], by by J. V. Kadeisvili [41] from Georgia, A. K. Aringazin [42] from Kazakhstan, and others. In fact ,these studies have established that all the various generalizations of the conventional Axioms 2.I - 2.V can be obtained from the Isoaxioms 9.I - 9.V via different expansions in terms of different parameters and with different truncations.

It should be also noted that the isoaxioms additionally verify the crucial invariant over time thanks to the LPS isosymmetry. By comparison, the various generalizations existing in the literature do not possess the crucial invariance over time, thus generally predicting different numerical values under the same conditions at different times.

The specialization of isorelativity to the iso-Galilean case is an instructive exercise for the interested reader [4].

9B. ISOAXIOMS FOR ROTATIONAL MOTIONS

Consider now the simple case of a rotation on a disc with ignorable thickness mass m, radius R, tangential speed

$$v_{tg} = \omega R, \tag{9.6a}$$

angular velocity

$$\omega = 2\pi v_{tg}, \tag{9.6b}$$

centrifugal acceleration at R

$$a_{ct} = v_{tg}/R = \omega^2/R, \tag{9.6c}$$

and centrifugal force at R for angular velocity ω

$$F_{ct} = ma_{ct} = m\omega^2 R. \tag{9.7}$$

Since there is no differentiation of space directions in the plane of the disc, the space characteristic quantities are given by

$$n_1 = n_2 = n_s, \tag{9.8}$$

where: s denotes an arbitrary radial direction in the plane of the disc; $n_3 = 1$ since the problem considered has only two space dimensions; the fourth characteristic quantity is the index of refraction n_4 (the geometrization of the density of the disc), and the local speed of light is $C = c/n_4$.

In this case special relativity is inapplicable for a number of reasons, such as the presence of centrifugal accelerations, the absence of inertial reference systems, etc. By contrast, isorelativity holds due to the universality of the LPS isosymmetry for all possible symmetric spacetimes. As an example, the considered disc within a physical medium can be represented with the line element

$$\hat{x}^{\hat{2}} = \frac{r_s^2 - t^2c^2/n_4^2}{R}\hat{I} \tag{9.9a}$$

$$\hat{I} = RDiag.(n_s^2, n_s^2, n_4^2) = 1/\hat{T} > 0.. \tag{9.9b}$$

$$n_\mu = n_\mu(t, r, v, a, \psi.....) > 0,\ \mu = s, 4, \tag{9.9c}$$

In this case, the LPS isosymmetry holds in full for isoinvariant (9.xxx) with the sole clarification that the speed v is now the tangential speeds, and the characteristic functions are reduced to n_s and n_4. We therefore have the following basic axioms for rotationsl motions, apparently introduced in this paper for the first time.

ISOAXIOM 9.I': The maximal causal angular velocity, centrifugal acceleration and centrifugal force for a disc of radius R and mass m rotating within a physical medium are the quantities at which the tangential speed at R is the maximal causal speed of Isoaxiom 9.1, and are given by

$$\Omega_{max} = \omega_c \frac{n_s}{n_4} \tag{9.10a}$$

$$A_{max} = \Omega^2_{max} R, \tag{9.10b}$$

$$F_{max} = m\, \Omega^2 R. \tag{9.10c}$$

where ω_c is the angular velocity for which the tangential speed at R is the speed of light in vacuum.

ISOAXIOM 9.II': The additional of angular velocities within physical media follows the law

$$\omega_{tot} = \frac{\omega_1 + \omega_2}{1 + \omega_1 \omega_2 / \Omega^2_{max}}. \tag{9.11}$$

ISOAXIOM 9.III': Within physical media, the behavior of time, length and mass with rotational velocities follows the isotopic laws

$$t' = \hat{\gamma}^{-1} t, \tag{9.12a}$$

$$\ell' = \hat{\gamma} \ell, \tag{9.12b}$$

$$m' = \hat{\gamma}^{-1} m, \tag{9.12c}$$

$$\hat{\gamma} = \sqrt{(1 - a/A_{max})} \tag{9.12c}$$

where ω is the measured angular velocity and a is the centrifugal acceleration at R for the angular velocoty ω.

ISOAXIOM 9.IV': The frequency isoshift for rotational motions within physical media follows the law

$$\nu = (1 \pm \ \omega/\Omega_{max} + ...)\nu_0 \tag{9.13}$$

ISOAXIOM 9.V': The mass-energy isoequivalence for rotating masses within physical media follows the law

$$E = m\, \Omega^2_{max} R^2 = m A_{max} R \tag{9.14}$$

where c is now the tangential speed at the radius considered.

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The best experimental verificaiton of the above rotational isoaxioms is that provided via the recent unadulterated Mossbauer experiment by A. Kholmetskii and his associates reviewed in Section 11.

10. Physical Interpretation of IsoRelativity.

Recall that the abstract identity between special relativity and isorelativity is such that the two relativities admit the same numerical value. For instance, the maximal causal speed on Minkowski-Santilli isospace is the conventional speed of light c in vacuum. Consequently, the physical interpretation of isorelativity can solely be seen in its *projection* on the conventional Minkowski spacetime, as illustrated in the representative cases below.

10.1) IsoCoordinates. The reconstruction of the exact light cone in isospace over isofields, Eq. (8.15), requires the identity of the coordinate of the observer from the outside of the medium along the k-axis $r_{k,obs}$ with the *isocoordinates* $\hat{r}_k = r_{k,int}\hat{I}_{k,r}$, where $r_{k,int}$ is the actual coordinate within the physical medium along the same k-axis,

$$\hat{r}_k = r_{k,int}\hat{I}_{k,r} = r_{k,int}\frac{1}{n_k} = r_{k,obs}, \;\; r_{k,obs} \neq r_{k,int}. \tag{10.1}$$

The distance $r_{k,obs}$ is then predicted as being *smaller* (*bigger*) then the actual distance in the inside $r_{k,int}$ depending on whether the index of refraction is bigger (smaller) than 1. As we shall see in Section 11, this prediction is confirmed by visual observations within transparent media, such as water, in which the $r_{k,obs}$ is notoriously different than $r_{k,int}$.

10.2) IsoTime. By remembering that no mutation of space can occur without a corresponding mutation of time, coordinate mutation (10.1) implies a corresponding mutation of time. In fact, the reconstruction of the exact light cone on isospace, Eq. (8.15), requires that the time of the observer from the outside t_{obs} be identical to the *isotime* $\hat{t} = t_{int}\hat{I}_t$, where t_{int} is the intrinsic interior time (e.g., of a living organism or a star), resulting in the identity

$$\hat{t} = t_{int}\hat{I}_t = t_{int}\frac{1}{n_4} = t_{obs}, \;\; t_{obs} \neq t_{int}. \tag{10.2}$$

By keeping in mind that, according to the experimental verifications reviewed in the next section, the index of refraction n_4 can be bigger or smaller than one depending on the local density and other factors, identity (10.2) implies that *the interior time can be in the past or in the future with respect to the time of the external observer.*

10.3) Maximal Causal Speeds. As it is well known, maximal speeds $V_{max} > c$ are prohibited by special relativity for particles moving in vacuum because of the violation of causality and other laws. A central feature of isorelativity with clear experimental verifications and far -reaching consequences is that the V_{max} of IsoAxiom 9.1 can be bigger or smaller than c depending on the local conditions of density, pressure, temperature, etc.

In particular, the value of the mass at c is not necessarily divergent at $v = c$ because the characteristic quantities have a velocity dependent, thus admitting the case

$$\frac{n_4}{n_3} = \frac{1}{v}f(x, v, a, , , , , \tag{10.3}$$

in which case, from Eq. (9.3c), we obtain the finite value

$$Lim_{v=c}\, m' = \frac{m}{\sqrt{1 - f(x, v, a, ...)}}. \tag{10.4}$$

Note additionally that *the maximal causal speed within a physical medium is generally different than the speed of light in that medium* for various reasons, such as to avoid the violation of causality or of the relativistic sum of speeds. in any case, physical media are

generally opaque to light, in which case the assumption as the maximal causal speed of a light that cannot even propagate within that medium has no physical sense (see Section 11 for brevity).

10.4) isoParticles. In 20th century physics, *elementary particles* are characterized by unitary irreducible representations of the LP symmetry for the dynamics in vacuum.[27] Along fully parallel lines, *elementary isoparticles* are isounitary irreducible representations of the LPS isosymmetry for the dynamics within physical media.

The main difference between particles and isoparticles is that the former solely hold under action-at-a-distance potential interactions, while the latter hold under a combination of potential as well as contact non-potential interactions. The physical implications are far reaching because, under the LP symmetry, particles can solely experience an alteration of their kinematic characteristics. By contrast, under the additional contact interactions, there is in general a mutation (or isorenormalization) of all *intrinsic* characteristics of particles, including mass, spin, charge, etc., as illustrated with the transition from mass to isomass, Eq. (10.5).

In turn, the alteration of intrinsic characteristics has permitted the solution of problems otherwise impossible with the conventional notion of particle, such as the synthesis of the neutron from a proton and an electron inside a star, or the synthesis of hadrons at large, with far-reaching implications, such as the reduction of matter to protons and electrons, new controlled fusions without radiations, and other truly innovative advances.

The most salient isorenormalization is that of the spin presented in Sections 8.VI and 8.VII. Additional isorenormalizations are presented below.

10.5) IsoRenormalization of the Mass. Another important prediction of isorelativity, at the foundation of most applications in particle physics and astrophysics,is that *the mass of particles experienced a mutation, called "isorenormalization" in the transition from the value in vacuum to that within physical media.* This occurrence was discovered in the original proposal to build hadronic mechanics, and it is now expressed via law (9.5b), with resulting mutation (isorenormalization)

$$m \to \bar{m} = m_s \frac{n_s^2}{n_4}. \tag{10.5}$$

In particular, the so-defined isomass can be bigger or smaller than the external mass depending, again, on local conditions.

Rather remarkably, the above mutation (isorenormalization) emerges very naturally in the isotopies of the Dirac equation, first derived in ref. [29], and reviewed in this paper in Section 8.V, Eq. (8.29).

It should be noted for readers not expert in the field that the isorenormalization of the mass for interior conditions has been crucial for the achievement of a quantitative

[27] This is the reason for which the dubbing of quarks as "particle" is essentially political, since the fractional charges of the conjectural quarks violate the LP axioms.

representation of the synthesis of mesons and hadrons since they have rest energies bigger than those of their constituents, thus causing the failure of the Schrödinger equation as we shall see better in the next section. Equivalence (9.5) causes an isorenormalization of the rest energy, under which consistency of dynamical equations is regained.

In particular, the isotopic identity

$$m_{ext} = m_{s,int}\frac{n_s^2}{n_4}. \tag{10.6}$$

predicts that *the maximal causal speed in the interior of hadrons, nuclei and stars is bigger than c.* As we shall see in Section 11, the synthesis of the neutron and hadrons at large require that $m_{int} > m_{ext}$ which is only possible for $n_4 < 1$, thus for $V_{max} > c$ since n_s is generally very close to one for particle cases (see Section 11 for details).

Yet another intriguing prediction of isorelativity is that *the numerical value of the interior mass depends on the direction s of its measurement,* particularly when dealing with non-spherical masses within an inhomogeneous and anisotropic medium. This implies that the mass of a spinning particle may have different values whether measured in the equatorial plane or along the rotational axis.

Non experts in the field should keep in mind that *there exists no "mass conservation law" in physics, since the only conservation law is for the energy,* that is, the sole invariant in Eq. (9.5a) is the energy, Consequently, for a given energy E, a given body, a given medium, and a given index of refraction n_4, there may indeed be local variations of m_s and n_s in such a way as to yield a constant E.

10.6) IsoRenormalization of Electric and Magnetic Moments. Another, well known, role of Dirac's equation is the characterization of the electric and magnetic moments for spin 1/2 particles in vacuum. The next advance of Ref. [29], Eqs. (6.5), page 190, was the derivation of the same result under isotopies, resulting in the following *isorenormalized electric and magnetic moments,*

$$\hat{\epsilon}_{\hat{e}} = \epsilon \times \frac{n_4}{n_3}, \;\; \hat{\mu}_{\hat{e}} = \mu \times \frac{n_4}{n_3}. \tag{10.7}$$

where ϵ and μ are the conventional magnetic moments in vacuum.

As we shall see in the next section, the above isorenormalization has allowed the achievement of the numerically exact and time invariant representation of the anomalous magnetic moment of the neutron in its synthesis from a proton and an electron in the core of a star.

The derivation of IsoRenormalization (10.7) is also an instructive exercise for scholars interested in research intended as the pursuit of *new* knowledge.

10.7) IsoEquivalence. The Poincaré-Einstein historical energy equivalence $E = mc^2$ was specifically referred to *point-like particles in vacuum,* under which condition the equivalence has received vast experimental verifications. However, the same equivalence principle has never received experimental verifications for *extended* particles, let alone for large

bodies, in which case said principle is merely assumed as being valid without a critical examination.

The representation of physical media via the isoline element (8.2) and its universal LPS isosymmetry clearly and uniquely predict the covering isoequivalence law (9.5) in which one can see the dependence of the energy output from the geometry of the medium.

As we shall see, IsoEquivalence (9.5) has truly intriguing implications from particle physics to astrophysics, e.g., because it eliminates the need for dark energy.

11. Experimental Verification of IsoRelativity and Relativistic Hadronic Mechanics.

11.1. Foreword. In the preceding sections we have identified *basic insufficiencies* of the 20th century formulation of special relativity and quantum mechanics in virtually all quantitative fields, and pointed out the existence of a *scientific obscurantism* caused organized interests on Einstein's theories via the suppression of due scientific process for qualified inquiries, the dismissal of clear experimental or visual evidence via purely conceptual models known to have no possible experimental verifications, the abuse of academic authority yo impose experimentally unverifiable conjectures over undesired experimental evidence, the consequential misuse of large public funds, and other non-scientific profiles.

In fact, virtually all 20th century quantitative sciences, from particle physics to astrophysics, have been essentially based on the preset, but generally unspoken intent of reconciling experimental data with special relativity and quantum mechanics without a serious scrutiny of their limitations. Consequently, much needed basic advances cannot be seriously achieved without the joint identification of the ongoing scientific obscurantism because, in the absence of such an identification, the *status quo* clearly persists via the mere oblivion or the use of other non-scientific means.

In this memoir, we have attempted to promote a much needed *scientific renaissance* as a necessary foundation for a *technological renaissance*, including new clean energies and fuels so much needed by mankind, which technological renaissance is an evident pre-requisite for a much needed *financial revival* at a point in our history of serious world wide financial problem that, in the event not resolved, may set the foundation for possible future, social, financial, ethnic, political and military upheavals. In this section we shall implement the last act of the main aim of this memoir, namely, *we shall outline the experimental verifications of the isotopic (that is, axiom-preserving) covering of 20th century formulations of special relativity and quantum mechanics under the conditions of their applicability (interior dynamical problems).*

Consequently, by central assumption, *we shall solely solely consider experimental verifications of classical and operator isotopic formulations for closed-isolated, variationally nonselfadjoint and non-Hamiltonian systems see Figures 2 for a classical example and Figure 3 for its operator counterpart), namely, systems that are isolated from the rest of the universe, thus verifying the ten conventional total conservation laws of the Lorentz-Poincaré*

symmetry, yet admitting internal contact, non-linear, non-local and non-Hamiltonian interactions that are inevitable whenever considering the dynamics of extended particles and electromagnetic waves within physical media.

Unless otherwise stated, *the systems considered will be restricted to be reversible over time* so as to avoid the use of time dependent isounits and isotopic element that has not been considered in this memoir for brevity. The expire,mental verification of the *genotopic, Li-admissible covering of the isotopic formulations for open, non-conservative and irreversible processes* cannot evidently be considered in this memoir due to the impossibility of outlining the basic formalist to avoid a prohibitive length (see the most recent account [35]).[28]

Readers glancing at this section without a technical knowledge of the preceding sections are discourage, for their own sake, from venturing judgments that, under such premises, can only be political and non-scientific.

11.2. Verification in Water. As recalled in Section 3.V, when the majestic validity of special relativity in vacuum is extended to water, there is the emergence of a number of inconsistencies, such as: the violation of causality in the event the speed of light in water is assumed as the maximal causal speed because electrons can travel in water faster than the local speed of light (Cerenkov effect); in the event the speed of light in *vacuum* is assumed as the maximal causal speed in *water,* there is the violation of the relativistic sum of speeds; etc.

A scientific obscurantism emerges from the fact that these inconsistencies published in refereed journals are widely assumed as being "resolved" by the reduction to photons of all electromagnetic waves propagating in water, the evident intent being that of recovering special relativity at the level of photons propagating in vacuum and scattering among water molecules. However, such a reduction is essentially conceptual and not truly scientific because said reduction to photon does not allow a quantitative representation of the experimental data, such as the angle of refraction, the reduction of about 30% of the speed of light in vacuum, etc. At any rate, the reduction to photon is meaningless, even conceptually, for radio waves with large wavelength that experience in water the same phenomenology as light (see Figure 4 for details).

[28]Isotopic theories are reversible over time (like 20th century formulations) because of the central assumptions of Hermiticity and positive-definiteness of the isounit and related isotopic element, $\hat{I} = \hat{I}^\dagger = 1/\hat{T} = 1/\hat{T}^\dagger > 0$. Under these conditions, the Lie-Santilli isoproduct is invariant under anti-Hermiticity, $[A\hat{,}B] = A\hat{T}B - B\hat{T}A = -[A\hat{,}B]^\dagger,\ A = A^\dagger,\ B = B^\dagger,$, which invariance is an axiomatic characterization of reversibility over time. However, the functional dependence of the isounit and of the isotopic element is completely unrestricted, thus admitting an explicit dependence on time, $\hat{I} = \hat{I}(t, ...) = 1/\hat{T}(t, ...)$, under which the isotopic representations are irreversible over time because not invariant under time reversal, $\hat{I}(t, ...) \neq \hat{I}(-t, ...)$. The latter isotopic formulations characterize closed-isolated systems verifying conventional total conservation laws, yet are irreversible over time as necessary to attempt a quantitative representation of the *internal entropy* with a much needed joint representation of thermodynamical laws. These closed-isolated irreversible systems are not considered within the context of isotopic formulations because they are a trivial particular case of Santilli's covering Lie-admissible formulations [35] and, as such, they are not considered in this memoir.

In the hope of stimulating a much needed scientific renaissance, isorelativity provides a numerical and time invariant resolution of said inconsistencies as follows: Light (as well as photons when applicable) are represented as transverse "waves" ("wavepackets") created and propagated by the universal substratum (the *ether*) because such a substratum is a necessary condition to explain the propagation in water of a light beam along a straight line without rapid and completion dispersal. In fact, the reduction of the "propagation" (and not the Einsteinian "absorption") of light to photons would imply that a very large number of photons must cross a very large number of nuclei without scattering as an evident necessary condition to represent the propagation of a light beam along a straight line. This implausible conception is avoided when light is represented as an electromagnetic wave created and propagated by the ether because the propagation occurs *in the substratum* and not *through nuclei.*[29]

Once we admit the Maxwellian physical reality of light as a transverse wave created and propagated by the ether, the numerical and time invariant representation of the propagation of light in water via isorelativity is immediate. By assuming that the speed of light in water is reduced by one third that in vacuum, the local light speed in water is represented with the historical, pre-Einstein expression (5.7), i.e.,

$$C = \frac{c}{n_4} = \frac{2}{3}c = 0.66\, c,\ n_4 = \frac{3}{2} = 1.5 > 1. \tag{11.1}$$

As we shall see, this return to the Maxwellian conception of light has far reaching implications (as we shall see later on, e.g., for neutrinos experiments) because it implies that *the presence of matter mutates the geometry of spacetime into the universal form (8.2) in such a way to cause a "decrease" of the speed of light.*

The consistent representation of this occurrence via Santilli's iso-Minkowskian geometry [3] has far reaching implications because it directly imp[lies the conjugate case with maximal causal speed bigger than that of light in vacuum.

To proceed, we have to note that, in its natural state, *water is locally a homogeneous and*

[29]The ongoing scientific obscurantism reaches a climax with the widespread denial of the universal substratum because "perceived" as being in conflict with Einsteinian views due to the expected privileged reference frame at rest with the ether. We reach in this way paradoxical extremes such as: the treatment of electromagnetic "waves" without a medium; entire new branched of physics, such as string theories, being developed with the strings being characterized by the vibration of nothing; and the like. In the physical reality, when dealing with dynamics in vacuum, the universal substratum cannot possibly be in conflict with Einsteinian views because, in the event we could somehow define a privileged frame at rest with the ether, there is no possibility for its experimental detection. The existence of the so-called "ethereal wind" (a claimed resistance that should be felt by bodies moving within the ether as a universal substratum) was dismissed by the author in 1957 [36] as well as by others because the ether is necessary for the very existence of the structure of elementary particles such as the electron that has been known for over a century to be pure vibration of a point of the ether. hence, the only effect in the change of a steady motion of the ether vibration is inertia without any possible ethereal wind. In the author's view, the sole widespread scientific obscurantism in the ether has historical proportions, since the study of the ether is the ultimate scientific frontier of the third millennium with potential advances beyond our imagination at this time, such as longitudinal waves traveling at a multiple of the speed of light in vacuum, locomotion at arbitrary speed swithout fuel thank, etc.

isotropic medium. Isorelativity then requires the identities

$$n = n_1 = n_2 = n_3 = n_4 = 1.5, \tag{11.2a}$$

$$\hat{I} = n^2\, I,\ \hat{T} = \frac{1}{n^2}\, I,\ I = Diag.(1,1,1,1), \tag{11.2b}$$

for which

$$V_{mas} = c\frac{n_3}{n_4} = c, \tag{11.3),}$$

namely, *the maximal causal speed in vacuum is the speed of light in vacuum,* thus confirming that the local speed of light within physical media *is not* the maximal causal speed. As we shall see, even though realized in a simple medium as water, this feature has far reaching implications because isorelativity necessarily predict the complementary case of maximal causal speeds bigger than the speed of light in vacuum.

Figure 18: *This picture illustrates the verification of isorelativity with water reflection. An external observer perceives a length r_{obs} which is illusory since the real length in the interior, r_{int}, is smaller than that perceived from the outside. This effect is numerically represented via isocoordnates (10.1) as shown in Section 11.2.*

It is evident that value (11.3) avoids the violation of causality in water by special relativity for electrons traveling faster then the local speed of light. Jointly, isorelativity verifies the axiom for the relativistic sum of speeds, although in its isotopic for (9.2) that reads for the case of water

$$V_{tot} = \frac{v_1 + v_2}{1 + \frac{v_1 v_2}{c^2}\frac{n_4^2}{n_3^2}} = \frac{v_1 + v_2}{1 + \frac{v_1 v_2}{c^2}}. \tag{11.4}$$

the invariance being solely applicable for the maximal causal speed and for the local speed of light in water, i.e.,

$$V_{tot} = \frac{V_{max} + V_{max}}{1 + \frac{V_{max}^2}{c^2}} = V_{max}. \tag{11.5}$$

Additionally, visual inspection provides an additional verification of isorelativity because, as well known, length in water predicted from the outside are *bigger* real length within water, exactly as represented by the notion of isocoordinates (see Figure 18) for which we have (e.g., for lengths along the third axis)

$$\hat{r}_{3,ext} = r_{3,int}\hat{I}_r = r_{3.int}\, n_3 = 1.5\, r_{3,int}, \tag{11.6}$$

namely, under numerical value (11.2), lengths predicted from the outside are about 1.5 bigger than the actual length under water, as established in nature.

Once reduced to its primitive geometric axioms, the latter visual evidence also has far reaching implications we shall indicated below, such as the prediction that photons emitted in interior conditions can be redshifted or blueshifted when detected from the outside depending on the density of the medium itself.

We finally note that for the case of water as well as for all cases of homogeneous and isotropic media, Santilli isotopies are characterized by the hidden trivial invariance of spacetime from values (11.2)

$$\hat{x}^{\hat{2}} = n^2 x^2 \hat{I} \equiv x^2\, I, \tag{11.7}$$

which is a trivial subcase of the regular isodilations (8.18) also called *isoscalar invariance* of the Minkowski spacetime.[30]

To understand the experimental verifications of this section, the interested scholar is suggested to meditate a moment on the rather deep physical implications of the seemingly trivial geometric property (11.7), when properly treated via the novel appropriate (rather than the old) mathematics, such as the abandonment of the speed of light as the maximal causal speed, etc.

In summary, a scientific renaissance can indeed be initiated beginning with simple interior dynamical problems such as dynamics in water, provided we admit physical reality and build a theory suitable for its quantitative and time invariant representation. in the author's view, this is the only way to resolve the scientific obscurantism emerging from our adaptation of physical reality to the preferred Einsteinian theories for evident personal gains. The same principle is valid for all subsequent verifications of isorelativity outlined below.

11.3. Verification via the IsoRedShift of Monochromatic Laser Light in our Atmosphere. Remember from Inapplicability 3.V, that special relativity cannot possibly be exactly valid in our atmosphere for a number of reasons, such as the inhomogeneity and anisotropy of our atmosphere compared to the strictly homogeneous and isotropic character of the Minkowskian spacetime, the presence in our atmosphere of particles (such as cosmic rays) traveling faster than the local electromagnetic waves, and other reasons. The author has conducted systematic mathematical, theoretical and experimental studies of

[30]Note that, without the multiplication of the last term by $I = Diag.(1, 1, 1, 1)$ (and consequential lift of the number n used in the 20th century formulation of special relativity into the simple subcase of Santilli isonumbers $\hat{n} = nI$ [8]) expression 911.,7) would be mathematically, geometrically and physically inconsistent./

the deviations expected from special relativity in the phenomenology of electromagnetic waves The central hypothesis formulated in 1983 [3] and then expanded in Refs. [4b] is the *prediction that mutations of spacetime of type (8.2) within physical media cause a shift of the frequency of light without any relative motion between the source, the medium and the observer,* called by the author "IsoRedShift" (IRS), when light loses energy $E = h\nu$ to the medium at generally low temperature, and "IsoBlueShift" (IBS) when light acquires energy $E = h\nu$ from the medium generally at high temperature. The prefix "iso" was included to denote the necessary use of the novel isomathematics for invariant treatments, as well as to denote the preservation of Einsteinian axioms (see Refs. [37,38] for details).

The prediction originated, quite forcefully, from the fact that the characteristic quantities can depend on velocities, $n_\mu = n_\mu(v, ...)$, in which case IsoAxioms 9.IV admits as a particular case a frequency shift at the value $v = 0$ in the s direction in space

Figure 19: *This station build by the author in 2009 to test the prediction of the alteration of the frequency of monochromatic laser light propagating in air without any relative motion between the source, the medium and the observer consisting of: an first air conditioned cabin (right) holding the laser at constant (generally low) temperature; a second air conditioned cabin (left) holding the wavelength analyzers also at constant temperature; the laser and the analyzer being interconnected by a pressure steel pipe containing air. the existence of Santilli IRS was established in June 2009 via comparative measurements of the laser light with a vacuum pulled out of the pipe and the same pipe with air at pressure [37,38].*

$$\frac{n_s}{n_4} = \frac{1}{v}\, cK + ..., \tag{11.8a}$$

$$\lambda_{final} = \lambda_{initial}/(1 \pm \frac{v}{c}\frac{n_s}{n_4}) = \lambda_{initial}/1 \pm K + ... \tag{11.8b}$$

where the signs $\pm$ occur for the IBS and IRS, respectively, and K can be locally approximated into a constant depending on local characteristics.

in response to requests to physics and astrophysics laboratory around the world over two decades to conduct experimental verifications or denials of the above predictions, the author received in "disqualifications" by colleagues for "incompetence," or "ignorance on special relativity" and the like. propagating in our atmosphere.

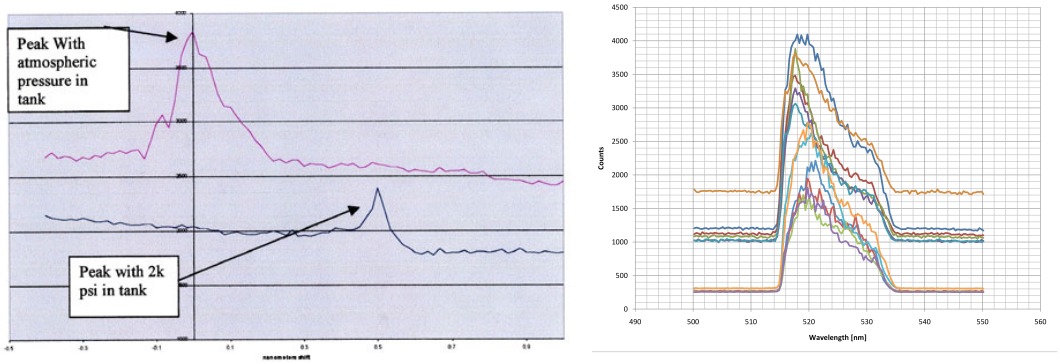

Figure 20: *A view of the first experimental confirmations of Santilli 1991 hypothesis [4b] of the the frequency shift of a monochromatic laser light in air without any relative motion between the source and the observer, called IsoRedShift (left view) and its increase with the increase of the air pressure, or the increase of the travel of the laser light in air (right view) achieved by the author in June 2009 [37,38] and independently confirmed by G. West and G. Amato in 2011 [39].*

Therefore, the author had no other alternative than that of conducting himself, with the assistance of his technicians, the needed measurements via first the construction of the *IsoRedShift Testing Station* (Figure 19), and then the conduction of systematic measurements over one year that confirmed in 2009 [37,38] the existence of Santilli IRS. It is evident that these measurements constitute some of the first experimental measurements establishing the inapplicability (rather than the violation) in our atmosphere of the 20th century formulation of special relativity.

Additional, independent, and comprehensive measurements were conducted by the American technicians G. West and G. Amato [39] who confirmed Santilli IRS and provided the first experimental evdience known to the author on the existence of Santilli IBS, by therefore confirming the main 1991 hypothesis according to which light loses energy to a medium when at low temperature and acquires energy from a medium when at high temperature.

in the author's view, by far the most important implications of measurements [37-39] is that they constitute the first direct experimental evidence on the validity of Santilli iso-Minkowskian geometry for physical media [30] since the entire body of experimental verifications presented in this section can be reduced to this primitive isogeometry.

11.4. Verification via the IsoRedShift of the Sun at Sunset and Sunrise. In the

preceding section, we presented experimental measurements of the IRS of a *monochromatic* laser light traveling in our atmosphere. However, the original 1991 proposal [4b] was to *test the IRS of the entire spectrum of Sunlight in the transition from the Zenith to the horizon for Sunset and Sunrise.* The IsoRedShift Testing Station (Figure 19) was build for monochromatic laser light as a preparatory step for the test of the full Sunlight spectrum due to the expectation that, once established for one frequency, the IRS should exist for all frequencies..

Figure 21: *In the transition from the Zenith to the horizon (Sunset and Sunrise), the Sun performs the transition from yellow to red, with a visible increase of the redness with the increase of the travel of light in air, without any appreciable relative motion between Earth and the Sun. This anomalous redshift has been proved by the author and his associates [38] as experimental confirmation of IsoAxiom 9.v as well as visual, let alone experimental evdience on the absence of the expansion of the universe since intergalactic spaces are far from being empty.*

Unlike the conditions valid for Eqs. (11.8) for which the relative speed was null by assumption, for the case of the redshift of the Sun (see Figure 21) we do have an essentially null relative motion between Earth and the Sun for the few hours needed for the measurements, but we do have indeed a relative velocity between the observer and the Sun given by the *tangential velocity* $v = |v_{tang}|$ relative to the Sun for the observer assumed for simplicity at the equatorial sea level.

In particular, v_{tang} is positive at Sunset, yielding a conventional Doppler's redshift, while v is negative at Sunrise yielding a conventional Doppler blueshift. However, simple calculations establish that the conventional Doppler shift is of the order of $10^{-6}\ nm$, while evidence establishes that the frequency shift from the yellowish color of the Sun at the Zenith to the red color at the horizon is of the order of about $55\ nm$, with shift values up to $200\ nm$ when including the shift to the infrared.

This occurrence mandated the use of isorelativity for a numerical representation of the

redshift of the Sun, with a time invariant representation via IsoAxioms 9.V studied for the first time in Ref. [40], Section 2.6, according to the expressions fort the case of Sunset

$$\lambda_{irs} = \lambda_{blue}/(1 - \frac{v}{c}\frac{n_s}{n_4}), \;\; \frac{n_s}{n_4} \approx 1 + K_{ss}d + ... \tag{11.9}$$

where K_{ss} can be well approximated into a constant for Sunset (ss) with dimension km^{-1} when the distance d covered by Sunlight in air is measured in km. under the above formalism we can then write the combined *Doppler-Santilli IsoRedShift*

$$\Delta\lambda = \lambda_{irs} - \lambda_{blue} = \frac{v}{c}(1 + K_{ss}d + ...)\lambda_{irs} = K_{ss}d\frac{v}{c}\lambda_{irs}, \tag{11.10}$$

In 2011, the author secured the Avantes wavelength analyzer model 3648-FCPC and initiated systematic measurements of the IRS of the Sun from the Zenith to the horizon. However, this particular analyzer was only able to detect wavelengths from 470 to $550\,nm$, rather than detecting the entire spectrum of Sunlight. Consequently, these initial measurements were inconclusive because, by its very definition [4b,40], the IRS of the entire spectrum of Sunlight at the horizon, when restricted to a subset of values, must coincide with the spectrum of Sunlight at the Zenith for the same subset of values, thus mandating the scan of the *entire* spectrum of light, plus the capability of including expected infrared values.

Therefore, the author secured the Yokogawa wavelength analyzer model AQ6373 capable of detecting Sunlight from 300 to $1200\,nm$ and achieved in early 2012 the first systematic experimental evidence establishing that Santilli IRS is indeed the primary origin of the redshift of Sunlight from the Zenith to the horizon, wit small contributions from the conventional Doppler's law.

These measurements confirmed the existence of an IRS of the order of $200\,nm$ when including the infrared, thus qualifying isorelativity in general, and the IRS in particular, as the *only* formulation available at this writing for a numerically exact and invariant representation of such a large IRS with basic relation for the case of Sunset

$$\Delta\lambda = K_{ss}d\frac{v}{c}\lambda_{irs} = K_{ss}\; 7000\; 1.43\; 10^{-6}\; 650\; nm = 200\; nm, \;\; K_{ss} = 30.7\; km^{-1}, \tag{11.11}$$

with corresponding expressions for the case of Sunrise (see Ref. [40] for brevity).

To confirm these results, the author secured the Avantes wavelength analyzer model AvaSpec-ULS2048 detecting Sunlight from 380 to $1100\,nm$ that provided final unequivocal experimental evidence that indeed the entire spectrum of Sunlight shifts toward the red in the transition from the Zenith to the horizon. In particular, the scans with the Avantes analyzer confirmed the IRS previously obtained with the Yokogawa analyzer of about $200\,nm$ when including contributions in the infrared (see Figures 22, 23 and Ref. [40] for details).

It should be noted that measurements [40] constitute the second experimental confirmation, following the first of Ref. [37], on the inapplicability (rather than the violation) in our atmosphere of the 20th century formulation of special relativity, its most important

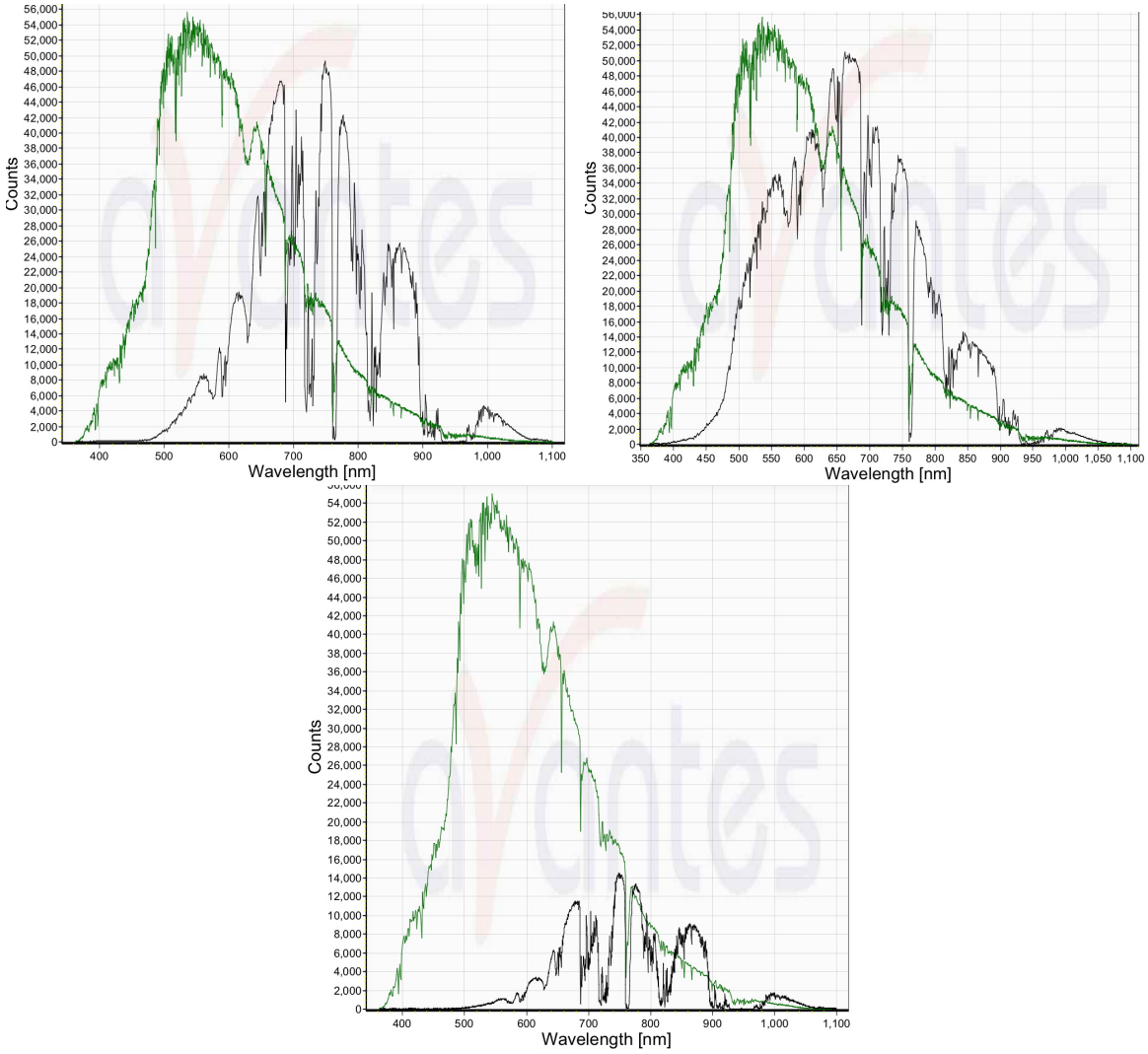

Figure 22: *Representative spectrograms of the entire Sunlight obtained in Ref. [38] via the Avantes wavelength analyzer model AvaSpec-ULS2048 detecting Sunlight from* 380 *to* 1100 *nm in the transition from the Zenith (top) to to Sunset (bottom), thus establishing the shift of the "entire" spectrum of Sunlight from yellow to red (for about* 55 *nm for the visible light, and then to the infrared (for a shift of about* 200 *nm. Isorelativity in general, and IsoAxiom 9.V in particular, have achieved a numerically exact representation of such a large frequency shift which is invariant over time (thanks to the LPS isosymmetry), which representation is simply beyond any dream of achievement via the conjectures of absorption or scattering [40]*

result being the confirmation of the validity of Santilli's iso-Minkowskian geometry [30] from which all experimental confirmations of this section follow.

A scientific obscurantism exists in this case too because the widespread interpretation of the redness of Sunlight at Sunset (Figure 21) is that it is due to absorption of Sunlight by our atmosphere as well as by the scattering of Sunlight among the air molecules. The unspoken, but well known, intent for these conjectures is that of reconciling the redshift of the Sun without relative motion Earth-Sun with Einsteinian theories.

However, the conjecture of $absorption$ is a grossly inconsistent the sky is $blue$ for the Sun at the Zenith in view of the physical law, expected to be known by expert to qualify as such, that redlight is absorbed air in the relative short vertical travel of about $60\ m$, thus establishing the impossibility for redlight to reach us in the much longer travel of about $6,000\ m$ when the Sun is at the horizon.

In short, had the sub be dark blue at the horizon., the conjecture of absorption as the origin of the frequency shift would have been physically meaningful, but the Sun at Sunset is red (Figure 21), thus confirming the scientific obscurantism in the field particularly when the absorption origin of the frequency shift is ventured by experts.

Consequently, in the event the Sun at the horizon were dark blue, then the absorption conjecture would be correct. But the Sun is red at the horizon, namely shows a color that cannot possibly survive the travel of sunlight in air for about $6,000\ m$, thus mandating the need for Santilli IRS to achieve a scientific, that is,m numerical and time invariant representation of evidence.

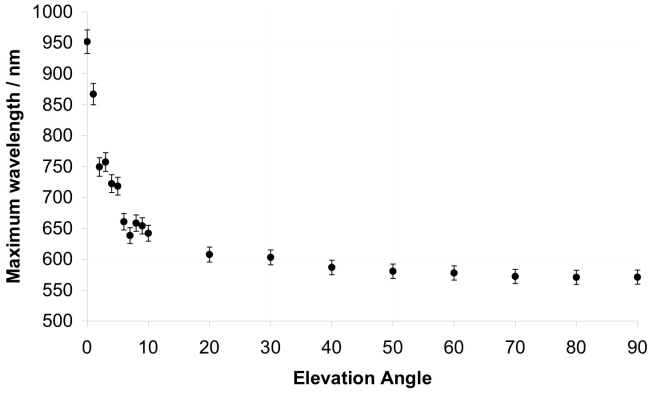

Figure 23: *An experimental confirmation of Santilli's IRS origin of the redness of the Sun at the Sunset obtained via the plotting of the wavefront of Sunlight with the decrease of the elevation on the horizon [40] confirming the need for a quantitative and time invariant representation of a redshift for about* 200 *nm soley possible to date thanks to isorelativity.*

Additionally, it is well known in both physics and chemistry that *the absorption of certain frequencies of light in a gas is set by the chemical characteristics of the gas, Therefore, the sole possibility for absorption to produce a redshift would be to change the entire Earth's atmosphere.* At any rate, the fixed character of the absorption line is clearly visible in the scans of Figure 22, thus establishing science over non-scientific conjectures.

The scientific obscurantism cause by the widespread conjecture that $scattering$ is the origin of the redness of the Sun at Sunset is perhaps more serious because ventured via sophisticated mathematical elaborations without a critical analysis of their physical content because [38-40]:

1) Boltzmann distribution establishes that scattering cannot cause any frequency shift because, for every contribution from an air molecule moving away from the source, there is an equal but opposite contribution due to a molecule moving toward the source, with consequential absence of actual frequency shift;

2) Despite its mathematical glitter, the scattering conjecture is purely conceptual, and therefore non-scientific, because of the known impossibility to achieve a scientific, that is, $numerical$ representation of the large redshift of Sunlight at Sunset which, as indicated above, is is of the order of $200\ nm$ when including the shift into infrared frequencies; and

3) Physical laws must be the same throughout the universe, as well known. However, for the case of the cosmological redshift of galaxies, the lack of redshift caused by scattering has been adopted since the early 20th century and recently proved experimentally [41]. By contrast, when passing to the redness of the Sun at Sunset, the scattering origin is widely accepted, even though the redshift of Sunlight is structurally the same as that of the cosmological redshift (since both of them are constituted by the shift of the entire spectrum of light toward the red), by keeping in mind that the impossibility for scattering to cause any frequency shift has been experimentally established in Ref. [39].

A scientific obscurantism then emerges rather forcefully from the excessive divergences between the experimental reality and the conjectures aimed at maintaining the validity of Einsteinian theories in our atmosphere for evident personal gains; the excessively conceptual nature of the widely accepted conjectures without visible quantitative representations; the clear double standard in venturing opposing conjectures for the redshift of the Sun and of galaxies in violation of scientific ethics and accountability; and other aspects.

The author has conducted systematic mathematical, theoretical and experimental studies on the redness of the Sun at the horizon in the hope of initiating a much needed scientific renaissance in the field, under the expectation that advances are seeded in a scientifically receptive (rather than the contemporary obtrusive) environment.

Readers glancing at the results herein reported are suggested, for their own sake, to abstain from venturing judgments without the prior repetition of the measurements due to their simplicity, low cost and scientific implications.

11.5. Verification via Kholmetskii's Measurements for Rotating Disks. The first experimental verification of IsoAxioms 9-I′ to 9.V′ for rotating disks has been recently recently achieved by the Belorussian physicist Alexander L. Kholmetskii and his associates [42] via the Mossbauer effect for rotating disks, resulting in the following numerical values for IsoAxioms 9.IV′

$$\nu = [1 \pm \frac{\omega}{\omega_c}\frac{n_4}{n_s} + ...]\nu_0 \tag{11.12a}$$

$$\frac{n_4}{n_s} = 1.2, \tag{11.12b}$$

$$\Omega_{max} = 0.80\omega_c. \qquad (11.12c)$$

thus establishing a clear deviation from special relativity axioms, in the sense that the numerical values of the deviations are a large multiple of the errors.

The scientific obscurantism in this field should be denounced too because all Mossbauer experiments on rotating disks prior to Kholmetskii's experiment aimed at *verifying* special relativity under conditions for which its axioms cannot be consistently formulated, let alone verified, due to the absence on an inertial reference frame in a rotating disk, the dominance of centrifugal accelerations, and other reasons (see Section 3).

Figure 24: *A view of the experimental; set up used by A. Kholmetsii et al. [39]. The rotor with the diameter* 600 *mm is located inside the shielding camera made from ultrastrong alloy. The proportional detector (black unit) is placed on the front side of the shielding. For safely purpose, the setup was operated from an adjacent room.*

Additionally, the accuracy of the measurements claiming verification of special relativity depute its inapplicability is questionable (see Kholmetskii's Lecture 9 of the *2011 San Marino Workshop* [43]), thus confirming shadows of obscurantism perhaps mandated by the known impossibility to date of publishing experimental results violating special relativity in any journal of any Physical Society in any developed country.

11.6. Verification by Arp's Connected Quasars and Galaxies. Besides the redshift of the Sun at the horizon without any appreciable relative motion between Earth and Sun, the study of isorelativity conducted in monographs [4] was also stimulated by the discovery by the American astrophysicist Halton Arp [44] of quasars physically connected to associated galaxies from clear gamma spectroscopic evidence, yet their cosmological redshifts are dramatically different (Figure 25).

these astrophysical measurements constitute *prima facie* evidence of the violation of 20th century formulation of special relativity within the physical media inside quasars and galaxies. In fact, had special relativity be valid, the quasar and related galaxies should

have separated billions of years ago and move away from Earth at dramatically different speeds in order to verify Doppler's Axiom 2.IV.

Volume [4b] provided in 1991 a numerically exact and time invariant representation of the very large differences in cosmological redshifts of associated quasars and galaxies via corresponding large differences between the huge chromospheres surrounding quasars and the much weaker physical media inside galaxies.

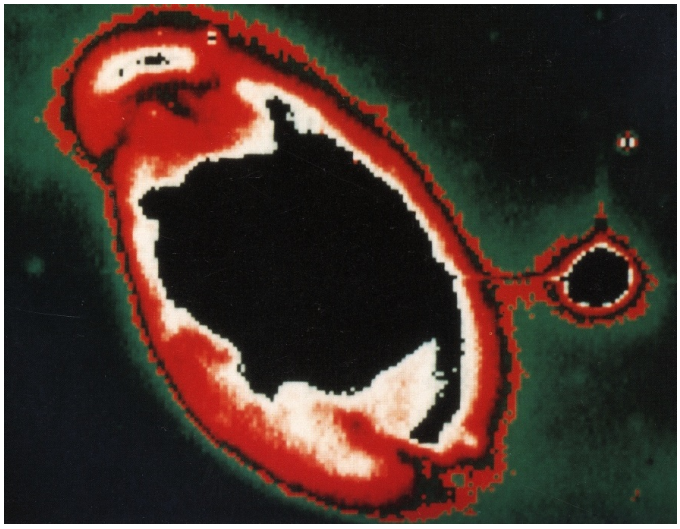

Figure 25: *Picture of one of Arp's quasar (r.h.s) and physically associated galaxy (l.h.s.) with dramatically different cosmological redshifts, which constitute clear violation of 20th century formulation of special relativity while providing an astrophysical confirmation of isorelativity, particularly the IRS of laser or Sunlight of refs. [35-38].*

Santilli's main 1991 idea is that light merely leave the quasar-galaxy system with dramatically different IRS due to dramatically different losses of energy by light to the quasar chromosphere and the innergalactic media. Ref. [4b] also provides a numerical prediction of the IRS in our atmosphere via an ap[proximate prorating of Arp's data, and proposed various tests.

In 1992, the Italian physicist Roberto Mignani [45] provided a representation of most pairs of quasars and associated galaxies known at the time via Santilli iso-Minkowskian geometry and IsoAxiom 9.IV resulting in the expression

$$\frac{b_s}{b_4} = \frac{[(\Delta f + 1)^2 - 1] \times [(\Delta f' + 1)^2 - 1]}{[(\Delta f + 1)^2 + 1] \times [(\Delta f' + 1)^2 + 1]} = B, \tag{11.13}$$

where $\Delta f'$ represents the IRS for the quasar and Δf represents the measured conventional redshift for the associated galaxy 9see Figure 26 for a summary of these confirmatory rsults).

Arp's discovery of associates quasars and galaxies with largely different cosmological redshift constitutes yet an additions dark page of the ongoing scientific obscurantism due

GAL.	ω'_1	QUASAR	B	$\hat{\omega}_2$
NGC	0.018	UBI	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 26: *A summay of Mignani's [45] 1992 exact representation of the large differences of cosmological redshift between quasars and their associated galaxies via Santilli 1991 [4b] iso-Minkowskian geometry and IsoAxiom 9.IV.*

to now familiar way of proffering the most hypothetical conjectures provided that they are compatible with Einsteinian theories, while much more plausible and quantitative alternative views are suppressed, opposed or disqualified. Perhaps the best evidence of the obscurantism in the field is that Arp's associated quasars and galaxies are virtually ignored in the orthodox literature in the field.[31]

11.7. Verifications in Cosmology. In order to separate scientific realities from conjectural hypotheses, let us recall that, besides cosmic radiations, *the only experimental information we have from distant galaxies is their light, with particular reference to the information derived from the discovery by the American astrophysicist Edwin Hubble [46] of the cosmological redshift, according to which the redshift of light from distant galaxies is the*

[31]The discovery by Halton Arp (a former colleague of the author when at Harvard University) in the early 1970s of quasars physically associated to galaxies with dramatically different cosmological redshifts constitutes indeed one of the darkest page of the ongoing scientific obscurantism on Einsteinian doctrines. In fact, following the announcement of his discovery, the American astrophysicist H. Arp was requested by the Jewish-American physicists Irvin Shapiro, Sidney Coleman and their associates at Harvard University to reconsider his announcement because of its evident conflict with organized interests on Einstein. Following his refusal, Arp's affiliation at Harvard University was terminated and he was subsequently prohibited the access to any astrophysics laboratory the world over, thus confirming the global character of the obscurantism and its underlying organized interests. When the author, an Italian-American scientist, received a research grant form the DOE (identified in memoirs [5]) to initiate the surpassing of Einsteinian doctrines via the broadening of their Lie algebra structure into the Lie-isotopic and Lie-admissible coverings, the Jewish American physicists Steve Weinberg, Shelly Glashow and Sidney Coleman, then at Harvard University, oppose the will of the Government of then United States of America because blatantly against organized academic, financial and ethnic interests on Einstein. The organized opposition was implemented via public denunciations that "Santilli's research has no physical value." said opposition intensified until the indicated research had to be continued outside Harvard University and said DOE grant had to be administered by the Institute for Basic Research (IBR), then located on Harvard Grounds. Subsequently, the IBR had to be moved to Florida sue to continuous organized obstructions by local interests on Einstein in the seven universities of the Boston area [14,15].

same for all galaxies having the same distance from Earth in all directions in space, and said redshift increases with the increase of the distance from Earth.

This experimental evidence has been interpreted via the following plethora of directly unverifiable cosmological conjectures, each intended in support of the preceding unverifiable conjecture, all conjectures being based, whether intentionally or *de facto,* to claim the exact validity of special relativity throughout the universe without a serious scrutiny of its limitations:

CONJECTURE 11.1: The cosmological redshift verifies special relativity Axiom 2.IV, namely, it is claimed as being caused by galaxies moving away from Earth at the same speed for the same distance from Earth in all directions in space (see, e.g., the comprehensive presentation by the Jewish-American physicist C. W. Misner et al. [47] or by the Jewish-Russian physicists A. Landau et al. [48]). The generally unspoken consequence is that Earth musty be at the center of the universe from Hubble's law (see Figure 27).

CONJECTURE 11.2: The speed of galaxies moving away from Earth as per Conjecture 11.1 increases with the increase of the distance from Earth (se, e.g., the American astrophysicisty P. Riess et al. [49]). This conjecture was voiced because mandated by Hubble's law and confirms the need for Earth being at the center of the universe.

CONJECTURE 11.3: The universe was born out a primordial explosion, the "big bang," occurred some $13,7$ billions years ago (see, e.g., the American astrophysicist E. J. Wollack [50]). This conjecture was voiced for the intent of maintaining the credibility of the expansion of the universe that, in turn was voiced to maintain the validity of special relativity for the cosmological redshift. From Conjectures 11.1 and 11.2 it is then evident that the big bang must have occurred in the galactic vicinity of Earth, thus again implying Earth at the center of the universe.

Figure 27: *An artist's rendering of the Middle Age conception of Earth at the center of the universe (left view), and an illustration of the contemporary conception of the expansion of the universe (right view) with the generally unspoken implication of Earth at the center of the universe since Hubble's law imply the same cosmological redshift for all galaxies with the same distance from Earth in all directions and such a redshift increases with the increase of the distance from Earth.*

CONJECTURE 11.4: Space itself is expanding throughout the universe (see, e.g., Ref.

[51] by the American astrophysicist A. B. Ehiting). This additional, manifaetsly unbverifiable conjecture was voiced in support of the preceding unverifiablke conjecture II.1, 11.2 and 11.3 for the studious, but generally unspoken intent to prevent a return to the Middle Ages with Earth at the center of the Universe, as inherent in said conjectures.

*CONJECTURE 11.5:*The dynamics of galactic stars depends on a mysterious invisible substance, the "dark matter," that permeate galaxies (see, e.g., the Jewish-American astrophysicist Vera Rubin [52]). This additional conjecture originated from the claimed anomalous velocity of stars with the increase of the distance from the galactic center. In reality the sole experimental evidence is that, in certain galaxies, the redshift for galactic stars remains mostly constant with the increase of the distance from the center, the claim of a constant speed from this experimental evdience being a personal directly unverifiable conjecture.

CONJECTURE 11.6: The dynamics of the entire universe depends on yet an additional invisible substance, the "dark energy," comprising over 95% of the energy in the universe (see, e.g., Ref. [53] by the American physicist P. J. pebble). This additional also unverifiable conjecture was voiced for the generally unspoken insufficiencies of the big bang conjecture (some of which are recalled below), in order to explain the expansion and the acceleration of the expansion of the universe.

CONJECTURE 11.7: The speed of light in vacuum c is the maximal causal speed throughout the universe, thus including intergalactic spaces as well as in the interior of stars, quasars and black holes. This yet additional conjecture is generally unspoken, but it is at the foundation of astrophysical calculations conducted in the preceding conjectures, e.g., to claim the energy equivalence of a black hole.

No ethical sound scholar can deny the emergence from the above chaim of conjectures of a scientific obscurantism of historical proportions from the widespread acceptance of the above plethora of directly unverifiable conjectures for a variety of historical, conceptual and technical reasons.

On historical ground, immediately following the discovery of the cosmological redshift [46], the Swiss astrophysicist Fritz Zwicky [54] and others submitted the hypothesis of the tired light, according to which *the cosmological redshift of galaxies is due to loss of energy $E = h\nu$ by light when scattering through intergalactic gases during the long travel to Earth.*

This hypothesis was submitted to prevent a return to the Middle Ages with Earth at the center of the universe (Figure 27), and was supported by R. Hubble, L. de Broglie, E. Fermi, and other famous physicists who died without believing in the expansion of the universe precisely in view of its inherent consequence of Earth at the center of the universe.

The scientific obscurantism emerges from the fact that *Zwicky's hypothesis provided a numerical representation of all cosmological redshifts as well as their increase with the increase of the distance without any need for the expansion ofd the universe.*

Additiona,ly, Zwicky's hypothesis was quite valid at the time of its submission because the theoretical and experimental dismissal of scattering as the origin of any redshift

was solely achieved in 2012 [39], thus being very plausible in the early 19th century.

Finally, the hypothesis of tired light was c;learly more plausible than the conjecture of the expansion of thje universe, as well as more plausible than the consequential conjecture of the acceleration of the expansion with trillions and trillions of galaxies accelerating their speeds for billions of years without any indication of the fact that the energy needed for such accelerated expansions would be so enormousto be veyoind our comprehension.

Despite all the above, Zwicky's hypothesis was dismissed and its distinguished supporters were silenced by world wide organized interests on Einsteinian theories via the abuse of academic authority and the suppression of scientific democracy for qualified views all this under large public financial support.

On conceptual grounds, the scientific obscurantism emerges from a number of paradoxical implications of Conjectures 11.1-11.7. For instance, to be true, the big bang should have caused the absence of galaxies around Earth for 13.7 billion light years which is grossly contrary to astrophysical evdience; following the claimed primordial explosion, the speed of the so-formed galaxies should decrease as per all explosions, which is contrary to the claimed acceleration; and other inconsistencies. The scientific obscurantism emerges quite forcefully on a number of technical grounds, such as:

11.A. Recent values of the cosmological redshift for galaxies at the edge of the known universe require entire galaxies traveling faster than the speed of light, thus in blatant violation of very theory intended to be preserved;

11.B. the claim that the background radiation is "evidence" of the big bang has no consistent scientific foundations because simple calculations show that, due to its weakness, the background radiation should have been absorbed by galaxies and intergalactic media billions of years ago, thus requiring for its very existence a continuous source of energy;

11.C. In the event equally distributed, dark matter and dark energy cannot possibly have any dynamical effect on stars and galaxies, respectively, as a result of which said conjectures have succeeded in derailing attention on the real issue (departures from special relativity), but said conjecture have failed to represent the effects for which they were proposed;

11.D. Zwicky's scattering origin of the cosmological redshift was (and remains) widely dismissed as "fringe science," while scattering is widely assumed as the origin of exactly the same physical event, the redness of the Sun at the horizon in flagrant adaptation of physical reality to preferred doctrines; and other equivocal occurrences.

The experimental evidence of Santilli IsoRedShift origin of the redness of the Sun at the horizon, as well as of its increase with the increase of the distance traveled in air by Sunlight, has provided direct as well as visual and experimental evidence of the absence of expansion of the universe, the absence of the acceleration of the expansion, the absence of the big bang, with consequential absence of the expansion of space itself because phjysical laws musty be the same everywhere throughout the universe [4a,35,37,38,40].

The experimental evidence on the IsoRedShift also eliminates the need for the conjecture of dark matter because the density of innergalactic media increases with the decrease of the distance from the galactic center, evidently because a density behavior yields precisely the cosmological redshift of galactic stars with the increase of the distance from the

center [4a,35,36,38]. Additionally, the Brazilian physicist Mario M. Everaldo de Souza [55] has shown that the formation and evolution of galaxies can be quantitatively represented without any need for the hypothetical and invisible dark matter.

The absence of dark energy clearly follows the elimination of the expansion of the universe and its acceleration. In any case, the assumption of IsoAxiom 9.V on the isoequivalence law readily accounts for 95% of the energy in the universe in addition to that computed with Axiom 2.V via the simple assumption that the maximal causal speeds in the interior of stars, quasars and black holes is a mere ten time bigger than the speed of light in vacuum [4a,35,37,40].

11.8. Verification via Nielsen and Picek Data for the Interior of Mesons. To our best knowledge, the first theoretical prediction of maximal causal speeds in the interior of hadrons bigger than the speed of light in vacuum (superluminal speeds) was submitted in 1982 by the Italian-American physicist R. M. Santilli [2]. the first phenomenological verification of superluminal speeds was reached in 1983 by the physicists H. B. Nielsen and I. Picek [56] from The Netherlands. [32]

Apparently, Nielsen and Picek were unaware of the superluminal character of their results, that was communicated to them by the author via letters and a number of works, e.g., via the isotopies of SR of paper [3]. All subsequent elaborations of the fits of experimental data in particle physics experiments confirmed said superluminal character of the hadronic constituents beginning from the k-mesons on (see the sections below and the general review by J. V. Kadeisvili and I. Gandzha [100]).

The main argument of Ref. [2] of 1982 is that the speed of light c in vacuum is indeed the maximal causal speed for point particle moving in vacuum under long range potential interactions as occurring, e.g., in the atomic structure. By contrast, the interior of hadrons is composed by a hyperdense medium as a result of which strong interactions are predicted to have a contact, zero-0range nonpotential component under which no limit can be credibly proffered for the maximal causal speed.

Iin 1993, Nielsen and Picek [56] conducted systematic elabloration of experimental data on mesons via the use of the conventional gauge theory, and concluded that the best fit was provided by the generalized metric

$$\hat{\eta} = Diag.\{(1-\alpha/3), (1-\alpha/3), (1-\alpha/3), -(1-\alpha)\}, \tag{11.14}$$

where α is a constant with numerical values different for different meson, which generalized metric provided an evident confirmation of Santilli isometric [3] published in the

[32] It should be indicated that the superluminal character of hadronic constituents has been pointed out by a number of authors (see, e.g., Ernst L. Wall *The Physics of Tachyons,* International Academic Press, 1995, and references quoted therein). However, to achieve compatibility with Einstein's theories, these studies assume the superluminal constituents of hadrons to be tachyons. Ref. [2] of 1982, besides being one of the first predicting superluminal hadronic constituents, is the first known to the author to treat superluminal hadronic constituents as physical particles thanks to the prior identification of the isotopies of Lie's theory (Section 7.I). In particular, the causal existence of superluminal speeds was the first prediction, now fully verified in diversified fields, of the isotopies of special relativity achieved jointly with paper [2] in Ref. [3] of 1983 thanks to the increase of the maximal causal speed possible within hyperdense media, IsoAxiom 9.I.

same year, nowadays considered the first experimental confirmation of the validity inside hadrons of Santilli iso-Minkowskian geometry [30] as expected from its direct universality for physical media [31-33].

In particular, Nielsen and Picket [*loc. cit*] provided the following explicit numerical values of Santilli isometric

$$\pi^{\pm}:\ \hat{\eta} =$$

$$= Diag.\{(1+1.2\times 10^{-3}),(1+1.2\times 10^{-3}),(1+1.2\times 10^{-3}),-(1-3.79\times 10^{-3})\},\ (11.15a)$$

$$K^{\pm}:\ \hat{\eta} =$$

$$= Diag.\{(1-2\times 10^{-4}),(1-2\times 10^{-4}),(1-2\times 10^{-4}),-(1+6.1\times 10^{-4})\},\qquad (11.15b)$$

which data imply the following maximal causal speeds in the ingterior dynamics from IsoAxiom 9.I

$$\pi^{\pm}:\ V_{max} = c\frac{1-3.79\times 10^{-3}}{1+1.2\times 10^{-3}}\ <\ c,\qquad (11.16a)$$

$$K^{\pm}:\ Vmax = c\frac{1+6.1\times 10^{-4}}{1-2\times 10^{-4}}\ >\ c,\qquad (11.16b)$$

thus providing the first experimental verification of superluminal speeds for the case of the Kaons, as indicated above.

The increase of the maximal causal speed from the subluminal value for Pions to the superluminal values for the Kaons is remarkable. Recall that all hadrons have essentially the same size with charge radius of about $1\ fm$. Consequently, the density of hadrons increases with the increase of their mass. It then follows that *Nielsen-Picek data confirm isorelativity with deviations from special relativity in the interior of hadrons that increase with the increase of the interior density.*

It was unfortunately for scientific knowledge that Nielsen and Picek interrupted all correspondence with the author at the moment they were notified by the latter in 1984 with paper [2,3] of 1982-1983 that their data imply maximal causal speeds bigger than that of light in vacuum, with consequential violation of special relativity.

11.9. Verification via the Anomalous Behavior of the Meanlives of Unstable Hadrons with Speed. To the author's best knowledge, the second experimental verification of causal superluminal speeds in the interior of hadrons was achieved in measurement of the anomalous behavior of the meanlives of unstabnle hadrons with speed.

In essence, the impossibility for special relativity to be exactly valid for all possible particle events was well known in the second part of the 20th century. For instance, Santilli proposed in his Ph. D. thesis in the mid 1960s the generalization of Lie algebras into the covering Lie-admissible algebras as a condition to represent the irreversibility of high energy scattering as well as of the irreversibility nature at large (see, for brevity, Monographs [11]).

Independently from Santilli, the Russian physicist D. I. Blokhintsev [57] proposed in 1964 the following test on the validity or invalidity of special relativity inside hadrons. In essence, Blokhintsev was fully aware of the fact that the center of mass behavior of a

hadron in a particle accelerator must follow special relativity because we have point-like particles moving in vacuum under action-at-a-distance interactions.

However, Blokhintsev was fully aware of the fact that the high density in the interior of hadrons causes inevitable non-linear and non-local effects that notoriously violate special relativity. Consequently, Blokhintsev proposed the measurement of the behavior of the meanlives with speed and proposed various generalizations of Einsteinian axiom 2.III. Blokhintsev proposal was then studied by numerous authors (see Vol. [11b] for complete literature).

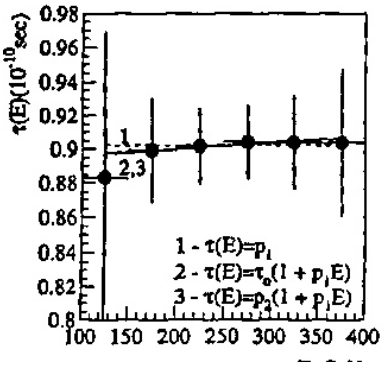

Figure 28: *A view of three plots made by Arestov et al. [60] via the use of Grossman's statistics of tests [56] on the speed (or energy) dependence of the meanlife of the neutral Kaons on the energy. Regrettably for scientific knowledge, the elaboration of the data was done by Grossman et al under the dominance of the PC violation to such an extent to show an apparent preset intent to have the lack of dependence of the meanlife on energy, thus implying an apparent preset intent to verify Einsteinian theories. It should be noted that the data elaborations by Aronson [55] has no such a dependence on PC violation effects, as a result of which tests [56] cannot possibly be considered a "verification" pf tests [55]. These and other equivocal aspects cast serious shadows on the acceptance by Phys. Rev. Letters for publication of the paper by Grossman et al. [59] without a serious scrutiny.*

It should be noted that the various generalized time evolutions proposed by Blokhintsev and others are all particular cases of Santilli isotime evolution 9.III,

$$t' = \hat{\gamma} t_o, \tag{11.17a}$$

$$\hat{\beta} = \frac{v_3/n_3}{c/n_4}, \;\; \hat{\gamma} = \frac{1}{\sqrt{1 - \hat{\beta}^2}}. \tag{11.17b}$$

In fact, the former generalized time evolution scan be obtained via suitable expansions in suitable parameters and suitable truncation of the latter due to its direct universality [31-33].

Also, Santilli's isotime evolution possesses the universal LPS symmetry that predicts the same numerical values under the same conditions at different times. By contrast, the

generalized time evolutions by Blokhintsev and others do not have such an invariance, thus predicting different numerical values under the same conditions at different times as per Inconsistency Theorem 7.1.

Eventually in 1983, an experimental collaboration headed by the American physicist S. H. Aronson [58] measured at Fermilab clear deviations from Einstein's time evolution law (2.7a) in the behavior of the meanlife of the K^0 in the energy range $30 - 100\ GeV$.

Tests [58] created serious hopes for the initiation of a scientific renaissance since in particle physics because in the same year (1983) we had the initiation of the studies on the isotopic covering of special relativity for interior problems [3], and its experimental verifications by Nielsen and Picek [56] as well as by S. H. Aronson [58].

Unfortunately, these hopes were short lived. In fact, organized interests on Einsteinian doctrines coordinated their action and succeeded in having a team headed by the Jewish-American experimentalist N. Grossman [59] to conduct "counter-measurements" also at Fermilab which claimed a confirmation the Einsteinian behavior of the meanlife of Kaons in the range $100 - 400\ GeV$.

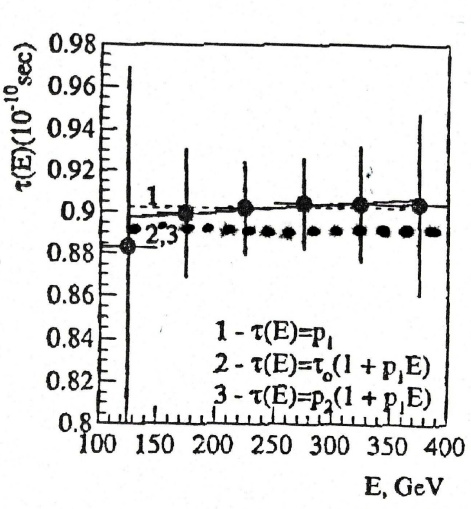

Figure 29: *A view of the re-elaboration of the data by Grossman et al [59] done by the author in Vol. IV of Refs. [18] establishing that the smallest variation in one of the numerous parameters, forma factors, etc. in said tests causes a violation of the Einsteinian time evolution law (2.7a), independently from the PC dominance commented in Figure 15 [60].*

The scientific obscurantism prior to 1983 was reinstated by tests [59] because of the subsequent widespread claim, including claims by editors of the journals of primary physical societies, that "Grossman's experiment has disproved Aronson claims and confirmed the validity of Einstein's time evolution law." The obscurantism is evidently caused by the fact that *Grossman's experiment did not disprove Aronson results, since the two experiments have different energy ranges, the first for* $100 - 400\ GeV$ *and the second for* $30 - 100 GeV$.

In addition, serious questions in the accuracy of Grossman's experiment were raised

by the Russia physicist Yu. Arestov et al [60] (see, Figure 28). Thereafter, the author reinspected again the data elaborations of Grossman's experiment and indicated their apparent adaptation of the data to Einsteinian theories (see Figure 29 and Volume IV of Refs. [18]). These and other equivocal aspects cast serious shadows on the acceptance for publication by Phys. Rev. Letters of the paper by Grossman et al. without a more serious scrutiny.

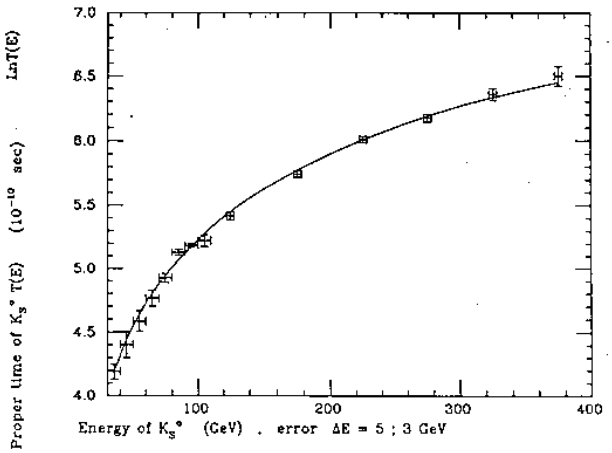

Figure 30: *A view of the representation of both tests, by Aronson et al [58] and by Grossman et al [59] done by Cardone et al [61,62] via Santilli iso-Minkowskian geometry [30-33].*

In 1992, the Italian physicist F. Cardone et all [61,62] established that Santilli's iso-Minkowskian geometry [30-33] represents exactly both, Aronson's and the Grossman's data, thus confirming the violation of 20th century formulation of special relativity within the hyperdense media inside hadron, as dictated by common sense in any case (see Figure 30). In particular, Refs. [61,62] reported the following experimental values of the characteristic quantities for the range $30 - 100\ GeV$ (Grossman's range $100 - 400\ GeV$ is here ignored because of the above insufficiencies)

$$1/n_1^2 = 1/n_2^2 = 1/n_3^2 = 0.9023 \pm 0.0004, \tag{11.18a}$$

$$1/n_4^2 = 1.003 \pm 0.0021, \tag{11.18b}$$

with consequential maximal causal speed

$$V_{max} = c\frac{1.003}{0.9023} = 1.111c\ >\ c, \tag{11.19}$$

in full agreement with value (11.xxx) within the accuracy of the latter.

It is hoped the serious scholar will admit the scientific obscurantism in this field also in view of the fact that *all* recommendations filed by the author and other scientists since 1988 to *all* particle physics laboratory around the world to conduct final resolutory experiments on the behavior of the meanlife of unstable hadrons with speed, have met with

silence or "disqualifications" on grounds such as "Grossman's experiment has resolved the issue."

11.10. Verification via the Bose-Einstein Correlation. As it is well known, the Bose Einstein correlation here referred to consists of: protons and antiprotons colliding at high energy; annihilating each other; and resulting into a hyperdense very elongated ellipsoid called the *fireball* that decays into a large of correlated mesons (see Figure 8).

Regrettably, the current widespread views on the Bose Einstein correlation constitutesan additional case of scientific obscurantism that has to be identified as a necessary condition for advances in the field.

In essence, the two points correlation function of the Bose-Einstein correlation is derived via relativistic quantum mechanical from the familiar expectation values of *two-dimensional* Hermitean Hamiltonian

$$C_k = \sum_{k=1,\,2} \langle s_k | H_{kk} | s_k \rangle, \tag{11.20}$$

whose off-diagonal elements, from the main axioms of relativistic quantum mechanics, must be null due to the Hermiticity of the Hamiltonian,

$$C_{ij} = \langle s_i | H | s_j \rangle = 0,\ i \neq j, \tag{11.21}$$

The expression of the two-point correction function derived from first axioms of relativistic quantum mechanics without adulterations is then given by

$$C_2 = N\ (1 + e^{-r^2 \times q^2}) \tag{11.22}$$

and results to be in dramatic disagreement with experimental data. In fact, their representation requires *four* arbitrary parameters (called the *chaoticity parameters*) whose numerical values are derived from the fit of the experimental data, after which derivation relativistic quantum mechanics is claimed as being exact for the Bose-Einstein correlation.

The scientific obscurantism first emerges in this case from the well known fact that *there is no possibility to justify the introduction of four different parameters from the quantum mechanical expectation values of a two-dimensional, Hermitean, thus diagonal, Hamiltonian.*

The scientific obscurantism is then confirmed by the oblivion, if not disqualification, of papers pointing out that *the four different chaoticity parameters are a direct representation of the deviations of the Bose Einstein Correlation from special relativity and quantum mechanical axioms.*

In fact, deviations from special relativity are established by the hyperdense character of the fireball with internal effects beyond any dream of quantitative representation via Einsteinian theories, while deviations from quantum mechamnics are established by the dramatic departures of the predictions of the theory from experimental data.

The first and only known, numerically exact and time invariant representation of the experimental data of the Bose-Einstein correlation from unadulterated primitive axioms

was f achieved by the author in memoir [63] of 1992 and subsequently confirmed by the Italian physicists F. Cardone and R. Mignani in Ref. [64] of 1996.

The main mechanism of the representation is constituted by the fact that, under the covering axioms of relativistic hadronic mechanics, the vacuum expectational values (7.42) become

$$\hat{C}_{ij} = \Sigma_{k=1,2} \langle s_i | \hat{T}_{ik} H_{kk} \hat{T}_{kj} | s_j \rangle, \ i, \ j = 1, \ 2, \tag{11.23}$$

where the 2×2-dimensional isotopic element $\hat{T}$ can be Hermitean but non-diagonal, thus allowing the needed four degrees of freedom to provide an exact representation of experimental data without adulteration of the primitive axisoms for personal interests.

The exact fit of the experimental data achieved in Ref. [63] and confirmed in Ref.]64] identified the following numerical values for the space characteristic quantities for the Bose-Einstein fireball (see Figure 31)

$$n_1 = 3.745, \ \ n_2 = 2.288, \ \ n_3 = 0.602, \tag{11.24}$$

which provide a numerical representation of the semiaxes of the very elongated fireball (normalized to the value 1 for the perfect sphere), and the all important numerical value on the geometrization of the density of the fireball 9also normalized to the value 1 for the vacuum)

$$n_4 = 0.605. \tag{11.25}$$

Consequently, in the interior of the fireball we have the maximal causal speed

$$V_{max} = \frac{(3.745 + 2.288 + 0.602)/3}{0.605} = 3.655 \ c' \tag{11.26}$$

the speed of photons

$$C = \frac{c}{n_4} = 1.652 \ c; \tag{11.27}$$

the isocoordinates

$$r_{ext,k} = r_{int} \ I_{r,k} = r_{int,k} \ n_k^2; \tag{11.28}$$

the isotime

$$t_{ext} = t_{int} \ \hat{I}_t = 0.654 \ t_{int}; \tag{11.29}$$

the IsoBlueShift

$$\nu_{ext} = \nu_{int} / (1 + \beta \frac{n_4}{n_3} + ...); \tag{11.30}$$

and the inertial mass of the fireball in the space direction s for a given measured energy E

$$m_s = \frac{E}{c^2} \frac{n_4^2}{n_s^2} / \tag{11.31}$$

Consequently, the exact fits of the experimental data of the Bose-Einstein correlation provide a direct experimental verification in the interior of the fireball of the following aspects:

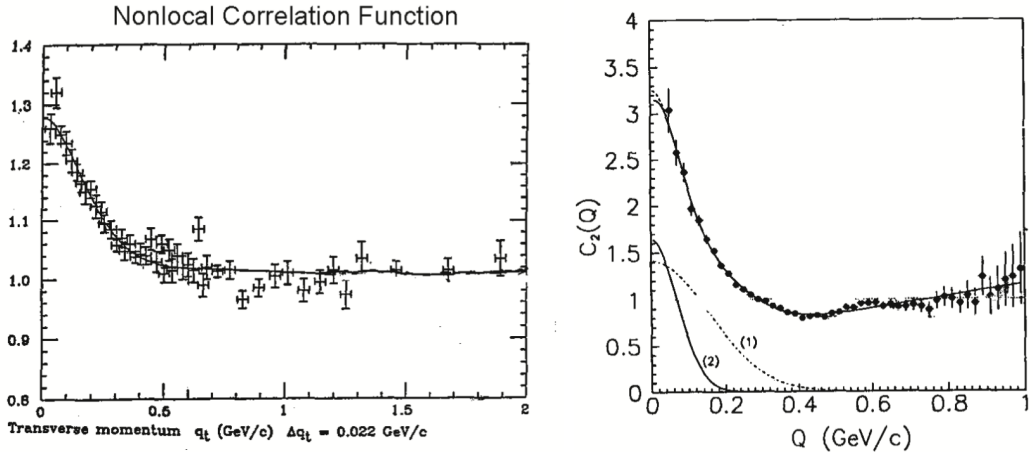

Figure 31: *A reproduction of the excellent fits of the two-point correlation function with experimental data on the Bose-Einstein correlation at high energy (left) and low energy (right) from the celebrated UA1 experiments at CERN, first published by Santilli in 1992 [63] and then re-examined by Cardone and Mignani [64] in 1996.*

10.1) All isoaxisoms of Santilli covering isorelativity, its underlying iso-Minkowski space and its universal LPS isosymmetry;

11.2) Fully causal and time invariant superluminal speeds (11.26), namely, maximal causal speeds bigger than that of light in vacuum that fully verify all causality laws, and have the same numerical value under the same conditions at different time thanks to the LPS isosymmetry;

10.3) Isoblueshifted photons (11.30), namely, the frequency of photons emitted from the interior of the fireball and measured in the outside is bigger than that of their internal emission due to the absorption of energy from the hyperdense and very hot fireball;

10.4) Distances in the interior of the fireball *smaller* than our distances, Eq. (11.28), thus implying a null dimension for the a gravitational singularity, which is an important feature for cosmology since it prevents the definition, let alone the evaluation of the dimensions of the universe ;

10.5) Time in the interior of the fireball *faster* than our time, Eq. (11.29), thus implying an infinite time for the interior of a gravitational singularity, which is another important feature for cosmology since it prevents even the definition, let alone the evaluation of the time of the universe;

10.6) The isotopic energy equivalence, IsoAxiom 9.V, for which the inertial mass of the fireball for a measured energy depends on the selected direction of measurement, Eq. 11.31); and

10.7) The reconstruction of the exact LP symmetry in the interior ofg the fireball at the isotopic level because the conventional LP symmetry is manifestly broken by the chaoticity parameters and related mutation of spacetime, yet the LP symmetry is reconstructed as being exact at the isotopic level due to the positive-definiteness of the characteristic quantities.

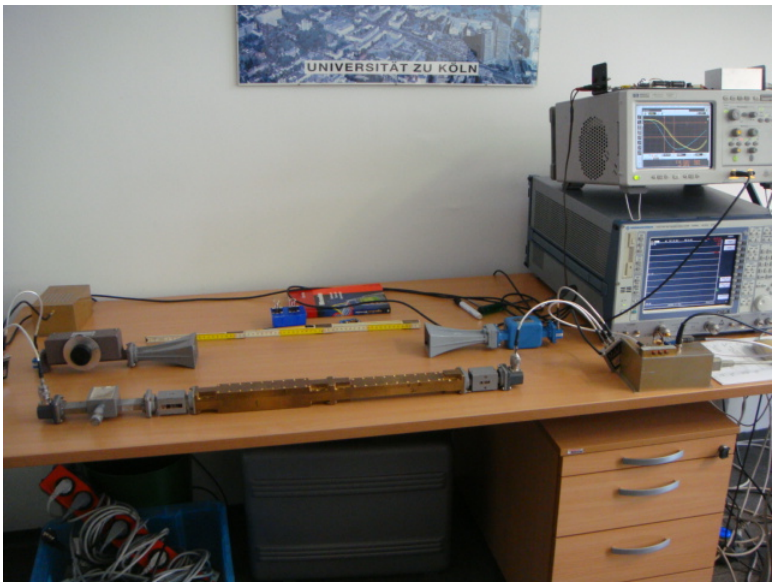

Figure 32: *A picture of Nimtz's guides [65] that allowed the transmission in 1992 of an entire Beethoven symphony at the superluminal speed of* 1.64 *times the speed of light in vacuum. Some of the guides are composed by a lattice made by a periodic dielectric hetero-structure fiber.*

in addition to the above results, the reader should know that *the numerical value of the density of hadronic matter, Eq. (11.25), has permitted the first quantitative representation of the synthesis of the neutron as occurring in stars from protons and electrons,* as outlined below.

11.11. Verification via Nimtz's Superluminal Communications. The preceding Sections 11.8, 11.9 and 11.10 dealt with experimental evidence on causal superluminal speeds for *particles* in interior conditions. The first experimental evidence of superluminal *electromagnetic waves* propagating within physical; media has been achieved, to our best knowledge, in 1992 by the German physicist Günter Nimtz and his associates [65-70].

To have a serious understanding of Nimtz's discovery beyond the level of a biased glance, the reader is expected to know the technical reasons of the fact that the preceding experimental confirmations of superluminal speeds for particles implies the existence of superluminal propagation of electromagnetic waves within suitable interior media.

The importance of Nimtz's experiments is that of having identified special guides, hereoon referred to as *Nimtz's guides,* essentially replacing fiber optics for the achievement of *superluminal communications.*

Nimtz et al initiated their experiments with a test in 1992 of superluminal) *tunneling* [65], during which the superluminal speed of $1.64\ c$ was measured. The *group* (rather than the phase) character of the superluminal speed was established by propagating an entire Beethoven symphony at that speed, thus confirming in this way the achievement of superluminal communications.

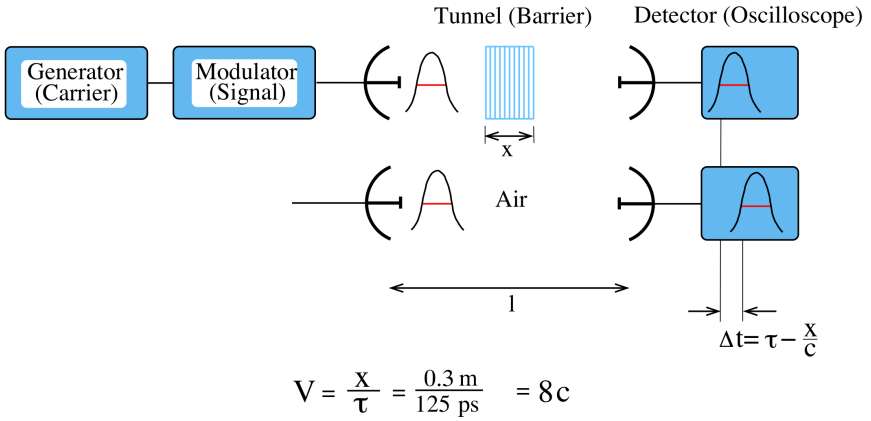

Figure 33: *A schematic view of Nimtz's set up to show via pulses that superluminal speeds are of group and not phase character. Note that the indicated speed of* 8 *c has recently been increased to* 20 *c [70].*

The studies were then continued in the subsequent experiments [66-68] that measured superluminal pulse tunneling and reflection transmission at microwave and infrared frequencies up to speeds of 20 c. Again, particular care has been taken by the experimentalists to prove that they are measuring group and not phase velocities.

In report [70], Nimtz introduces new experimental and theoretical data on superluminal tunneling and reflection. Data of barrier length independence and of reflection by barriers have evidenced the *non-local* nature of transmission. The expexperimentalists have also measured anomalous reflections from *asymmetric* barriers.

We know nowadays that causality laws are not violated by the superluminal speeds here considered even though the time duration between cause and effect can be shortened compared to the time of a luminal interaction exchange.

The first motivation got the causality of Nimtz superlum,inal speeds is that by the author, and consists in interpreting the propagation of the electromagnetic waves as occurring in interior conditions, This interpretation is warranted by the indicated non-local and non-symmetric conditions activating the LPS isosymmetry for which interior speeds can indeed be superluminal.

The second motivation is that by Nimtz via the tunnel effect, and it is based on the fact that time is null inside a barrier, the sole applicable time being at the barrier entrance and exit. An empirical and theoretical relationship independent from the barrier system has found for the tunneling time which is consistent with experimental measurements and compatible with superluminal tunneling.

In the author's view, there is no doubt that the tunneling interpretation is indeed fully valid whenever we are dealing with electromagnetic frequencies admitting a consistent reduction of photons, in which case, tunneling and isotopies are interpretations complementary to each other.. However, the tunneling interpretation becomes debatable for electromagnetic waves of large wavelength, such as infrared or bigger wavelengths, in which case the sole consistently applicable interpretation is the isotopic one.

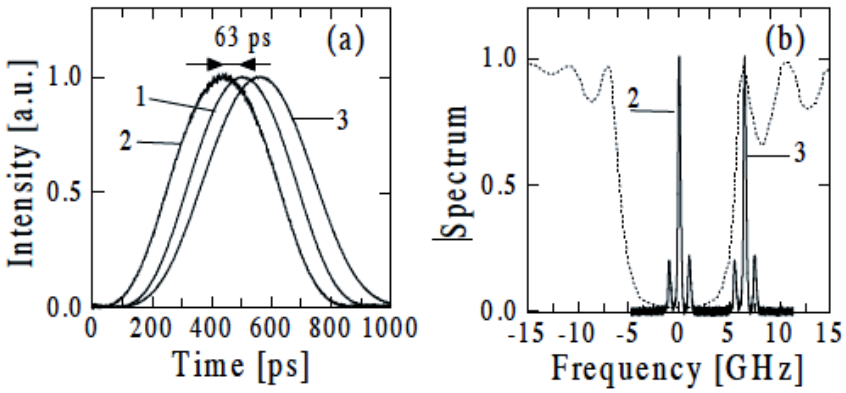

Figure 34: *Measured propagation time of three digital signals: Pulse trace 1 was recorded in vacuum. Pulse 2 traversed a photonic lattice in the center of the frequency band gap at the speed of about* 2 c*, and pulse 3 was recorded for the pulse traveling through the fiber outside the forbidden band gap [70].*

There is no doubt that Nimtz's superluminal guides are a scientific reality today and it is only a question of time to see their industrial development as a major advance over fiber optics.

A scientific obscurantism has to be identified in this field too, this time, consisting in venturing various denials of Nimtz's results, blatantly voiced for the intent of preserving the universality of Einsteinian theories, but without any prior repetition of the tests. In the reality of serious science, *experiments can only be dismissed via counter-experiments.* Consequently, the dismissal of experiments via unverified conceptual claims under the abuse of academic authority is indeed scientific obscurantism.

11.12. Verification via the CERN/GRAN SASSO Superluminal neutrinos. The various causal superluminal events reviewed in this section were studied in detail at the *International Workshop in Astrophysics and Cosmology for Matter and Antimatter* held at the Republic of San Marino from September 5 to 9, 2011 (see the website http://www.workshops-hadronic-mechanics.org/).

Subsequently, on September 24 the joint laboratories CERN/GRAN SASSO announced the measurement of neutrino traveling underground at superluminal speeds from Geneva, Switzerland, to the underground laboratory in the Gran Sasso Mountain in central Italy [70a]. The measurements were subsequently confirmed [70b] and the scientific paper [70c] released in free pdf download and submitted for publication.

Immediately following these announcements, there great excitement from serious scientists interested in seeking new knowledge, as well as a chorus of criticisms by evident members of organized interests on Einstein on grounds that *"superluminal neutrinos violate causality."*

These criticisms were soon dismissed as being grossly political because a high school student knows that Einstein special relativity cannot be even defined underground, and

that any verification of the constancy of light underground is ridiculous since light cannot even propagate underground.

Once the grossly political character of the criticisms became known jointly with the causal description of superluminal neutrinos permitted by the Lorentz-Poincaré-Santilli isosymmetry, criticisms were studiously refocused toward unverifiable aspects, such as details in the equipment used in the neutrino detection or other parts of the experimental set up.

It then became internationally known and denounced that, following the announcement of speeds beyond those permitted by Einstein theories, he world highest academic, financial and Jewish interests on Einstein converged at CERN by acquiring its control, forces the resignation of the group leader Antonio Ereditato, prevented the publication of paper [70c] by blatantly manipulated "arguments," quickly conducted a pre-meditated "revision" of the experimental data, immediately published in the highest physics journal (*Physical review letters*) rebuffal [7c], and quickly used the latter to dismiss any deviations from Einsteinian theories.

However, a simple analysis of paper [70d] shows that it is sufficient to change even minimally one or another aspects, such as form factors, expansion parameter, etc., to achieve compatibility of the result with Einsteinian theories. Additionally, the language used in paper [70d] is grossly political since it carefully avoid the use of caution terms such as 'apparently" and the like,m and claims instead quite strong results, whose lack of scientific character is evident to all physicists in good faith.

the grossly political character of the manipulations occurred in this episode is finally sealed in history by the fact that, even assuming the neutrino speed as being subluminal, the most corrupt scientists are expected to admit that Einstein special relativity is grossly inapplicable undergrounds in favor of the covering isorelativity.

Hence, the author believes that the episodes surrounding the 2011 detection by CERN-/GRAN SASSO laboratories of superluminal neutrinos constitutes one of the darkest moment in the history of physics that will allow organized academic, financial and Jewish interests on Einstein theories to maintain the control of physics, with the reception of the related billions of dollars in research funds, for the foreseeable future, thus creating a sinister obscurantism which is and will remain one of the darkest shadow in the exploitation of mankinf by a minority of Jewish people for their sinister personal gains while suppressing even the shadow of any serious scientific democracy.

11.12. Verification via the Synthesis of Light Mesons. One of the most elementary reactions in particle physics is that of the synthesis of the π^0 meson via the collision of an electron and a positron. This synthesis is then followed after about $10^{-16}\ s$ by the spontaneous decay of the synthesized particle with the lowest mode into the original particles, i.e.,

$$e^+ + e^- \to \pi^0 \to e^+ + e^-. \tag{11.32}$$

When in 1978 he was at Harvard University under DOE support, the author attempted a representation of the synthesis of the π^0 from an electron and a positron via conventional, quantum mechanical, non-relativistic and relativistic equations and also failed for

various reasons, such as:

1) The sole bound states admitted by the Scödinger equation are those for which the rest energy of the bound state is smaller than the sum of the rest energies of the constituents, this resulting in the familiar "negative" binding energy" in nuclear, atomic and molecular physics. By contrast, the achievement of a consistent bound state of an electron and a positron with the characteristics of the π^0 meson requires about $133\ MeV$, thus requiring a "positive" binding energy" for which the Schrödinger equation no longer admit physically meaningful solutions.

2) The scattering cross section of an electron and a proton at the needed $133\ MeV$ relative energy to synthesize the π^0 is virtually null, thus preventing a scientific, that is, quantitative representation of the synthesis of the π^0 via the relative energy of the electron and the positron;

3) The representation via quantum mechanics of the mean life of the π^0, its charge radius and other features yields numerical values excessively different then the experimental values; and other reasons.

These difficulties lead to the author's proposal in 1978 to build a covering of quantum mechanics under the name of $hadronic\ \ mechanics,$ based on the isotopic and genotopic liftings of Lie's theory], and then of the corresponding liftings of Schrödinger and Heisenberg equations characterized by these generalized algebras [1b]. The main features of the proposed new mechanics fully valid to this day were:

CONDITION I: The time evolution of hadronic mechanics has to be a $non\text{-}unitary$ when elaborated with the mathematics of quantum mechanics (Hilbert spaces over the field of complex numbers, etc.);

CONDITION II: The mutual penetration of spinning particles in singlet coupling at distances of $1\ fm$ must be strongly attractive while that in triplet must be strongly repulsive; and

CONDITIONS III: Hadronic Mechanics has to recover quantum mechanics uniquely and identically for all mutual distances of particles bigger than $1`fm$.

The validity of this conception was established by proving in Section 5 of memoir [5b] that the proposed hadronic mechanics allows the achievement of a numerical representation of all characteristic of the π^0 meson via one single hadronic structure equation. The presentation of the model in the 1978 memoir [5b] remains the best in the problem to this day.

Santilli's starting point is the representation of the positronium, hereon denotes $(e^+, e^-)_{qm}$ in quantum mechanics (qm) via the celebrated Schrödinger equation

$$\text{Positronium} = (e^+, e^-)_{qm}: \quad \left[-\frac{\hbar^2}{m_e}\Delta - \frac{e^2}{r}\right]|\psi\rangle = E|\psi\rangle, \tag{11.33}$$

where $m_e = 0.511\ MeV$ is the rest energy of the electron 9and the reduced mass of the positronium), and the reader not expert in the limitations of the Schrödinger equations should keep well in mind the $negative$ value of the binding energy.[33]

[33]An excellent exercise for non-expert is to attempt the solution of Eq. (11.33) with the sole change of

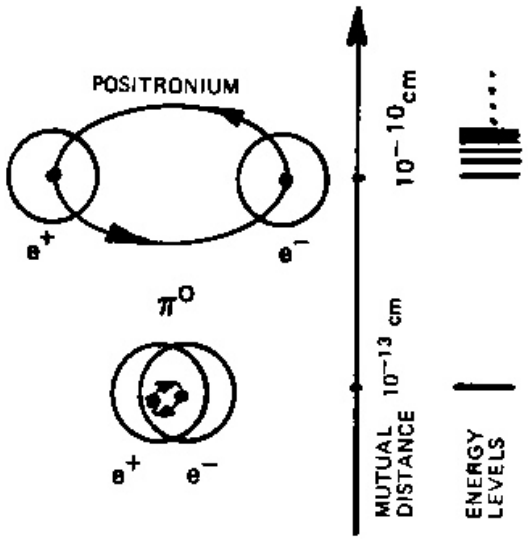

Figure 35: *An illustration of Santilli's structure model of the π^0 meson (developed in details in Section 5, Ref. [5b] of 1978) as a "compressed positronium," namely, as a bound state of an electron and a positron in singlet coupling at 1 fm mutual distance under the laws of hadronic mechanics, while any excited state recovers the quantum mechanical structure of the positronium.*

Since the electron and the positron originating sequence (11.32) are spontaneously emitted in the decay, Santilli assumed them as the actual physical constituents of the *structure* of the π^0 meson, while assuming as fully valid the $SU(3)$ *classification* of mesons, and assuming that quarks are what they technically are, purely mathematical representations of a purely mathematical symmetry in a purely mathematical internal complex-valued space, without any possibility of being defined consistently in our spacetime, as well know by "experts" to qualify as such, but not admitted.

Santilli then applied the main rule of the proposed hadronic mechanics (hm), namely, subject quantum equation (11.33) to a non-unitary transformation that, if properly selected, would yield the structure model of the π^0 according to the rule

$$\pi^0 = (\bar{e}^+, \bar{e}^-)_{hm} = U(e^+, e^-)_{qm} U^\dagger, \; UU^\dagger \neq I, \tag{11.34}$$

where $\bar{e}$ denotes mutation of the conventional electrons caused by deep mutual immersion, fully identified in the original proposal of 1978 [5b] where the mutated electrons were called *eletons.*

The prop[er selection of the non-unitary transform then led to the following *structure model of the π^0 mesons with physical constituents* providing a quantitative representation

the "negative" sign of the binding energy into a "positive" sign. Only then the collapse of physical value of the Schrödinger equation can be really seen.

of "all" characteristics of the particle (Eqs. (5/1/14, page 836, Ref. [5b])

$$\left(-\frac{1}{\bar{m}}\Delta - N\frac{\exp(-r/R)}{1-\exp(-r/R)}\right)|\hat{\psi}\rangle = E'|\hat{\psi}\rangle, \tag{35a}$$

$$\text{Rest energy}:\ E_{\pi^0} = E_{\hat{e}^-} + E_{\hat{\psi}^+} - |E'| = 134\,\text{MeV}, \tag{11.35b}$$

$$\text{Meanlife}:\ \tau_{\pi^0}^{-1} = 4\pi|\hat{e}(0)|^2\alpha E_{\hat{e}} = 10^{16}\,\text{sec}, \tag{11.35c}$$

$$\text{Charge radius}:\ R_{\pi^0} = 1\,\text{fm} = 10^{-13}\,\text{cm}, \tag{11.35d}$$

$$\text{Magnetic and electric moments}:\ M_{\pi^0} = 0, \tag{11.35e}$$

$$\text{Charge}:\ C_{\pi^0} = 0, \tag{11.35f}$$

$$\text{Charge parity}:\ P_{\pi^0} = +, \tag{11.35g}$$

$$\text{Space parity}:\ S_{\pi^0} = -, \tag{11.35h}$$

where one should note the assumption that $\hbar$ is absorbed in the non-unitary transform, and one recognize in Eq. (11.135a) the Hulten potential.

The first important notion introduced in Ref. [5b] is the "suppression of the quantum emchanical mass spectrum" as a necessary condition to exit from the *classification* approach and enter into the *structure* problem of each individual element of a given classification mass spectrum.

The above suppression was achieved via the Hulten potential that, as well known, has a *finite energy spectrum.* The condition of representing the various features of the π^0 then allowed Eq. (11.35a) *one* energy level and one only, that of the π^0. All excited levels of the mutated electron and positron were at distances bigger than $1\ fm$, thus being energy levels of the positronium (see Figure 35).

The consequence of the basic suppression of the mass spectrum was that *the number of physical constituents of light mesons increases with the increase of their mass, each meson having its own structure different than those of other mesons.*

The second important notion introduced for the first time in memoir [5b] is that of mutation of the constituents of the π^0, namely, *the electron and the positron experience an alteration of their "intrinsic" characteristics in the transition from the structure of the positronium to that of the* π^0, i.e.,

$$e \to \bar{e} \tag{11.36}$$

This hypothesis was conceptually evident due to the total mutual immersion of the wavepackets of the constituents, and technically realized via the mutation of Lie algebras into Lie-isotopic algebras worked out in the preceding memoir [5a].

The mutation of electrons and positrons then implies the mutation of their rest energy, introduced for the first time by Santilli in 1978 (Eq. (5.1.36), page 841, Ref. [5b] and following), now called *isorenormalization,*

$$m_e = 0.511MeV \to \bar{m}_e = 68\ MeV. \tag{11.37}$$

In turn, the above mutation/isorenormalization permitted the achievement of a consistent non-unitary generalization of the Scödinger equation, today called the *Schrödinger-Santilli isoequation,* due to the recovering of a *negative* binding energy.

It should be noted that the binding energy characterized by the Hulthen potential, here representing strong interactions, is essentially null (Eq. (5.1.35), page 841, Ref. [5b]), thus confirming a main principle of hadronic mechanics according to which *strong interactions have a contact non-Hamiltonian component due to the necessary mutual penetration of wavepackets and/or charge distributions that, being of contact type, for which the notion of potential energy has no physical sense.*

The sole binding energy which can be consistently defined for Santilli structure model of the π^0 is that originating from the Coulomb attraction among the constituents. The latter was not considered in the original derivation because the Coulomb potential is "absorbed" by the Hulten potential at short distances.

Structure model (11.35) was easily iterated in Section 5 of memoir [5b] via the embedding new electrons and/or positrons into a given r meson, resulting in the increase of the density under the preservation of the charge radius (a necessary condition to activate non-Hamiltonian strong forces). In different terms, the preservation of the charge radius of mesons with the increase of their ,mass lead to a necessary increase of the number of constituents with the increase of the mass.

For instance, the transition from the π^0 to the $\pi^\pm$ was done along the following kind of "bootstrapping" under the laws of hadronic mechanics

$$\pi^\pm = (\bar{\pi}^0, \bar{e}^\pm)_{hm} \equiv (\bar{e}^+, \bar{e}^\pm, \bar{e}^-)_{hm}, \tag{11.38}$$

thus allowing a quantitative representation of the spontaneous decay of the $\pi^\pm$ with the lowest mode

$$\pi^\pm \to e^+ + e^\pm + e^-. \tag{911.39}$$

The implementation of the above principle then led Santilli the following structure models of light mesons, each representing the *totality* of the physical characteristics of each considered meson, including rest energy, meanlife, charge radius, spin, charge, magnetic moment, parity and spontaneous decays (see again Section 5 of Ref. [5b]):

$$\pi^0(134\,\mathrm{MeV}) = (\hat{e}^+,\, \hat{e}^-)_{\mathrm{hm}}, \tag{911.40a}$$

$$\pi^\pm(139\,\mathrm{MeV}) = (\hat{\pi}^0,\, \hat{e}^\pm)_{\mathrm{hm}}, \tag{11.40b}$$

$$\eta(547\,\mathrm{MeV}) = (\hat{\pi}^0,\, \hat{\pi}^0)_{\mathrm{hm}}, \tag{11.40c}$$

$$K^\pm(494\,\mathrm{MeV}) = (\hat{\pi}^0,\, \hat{\pi}^\pm)_{\mathrm{hm}}, \tag{11.40d}$$

$$K^0_S(498\,\mathrm{MeV}) = (\hat{\pi}^0,\, \hat{\pi}^0,\, \hat{\pi}^0)_{\mathrm{hm}}, \tag{11.40e}$$

$$K^0_L(498\,\mathrm{MeV}) = (\hat{\pi}^0,\, \hat{\pi}^0,\, \hat{\pi}^0)_{\mathrm{hm}}. \tag{11.40f}$$

A most important implication of the above models is that *all light mesons can be reduced to hadronic bound state of electrons and positrons.*

The compatibility of the above structure model of light mesons with their required Santilli to construct the *multi-valued hyperstructures with a hyperunit* achieved in mathematical memoir [10] of 1996 we cannot possibly review here and at the physical level the subsequent year in memoir [71] via the *eight-valued hyperunit*

$$\hat{I}_{tot-oct} = \Big(\hat{I}_{\pi^0(135)},\, \hat{I}_{\pi^+(140)},\, \hat{I}^{+d}_{\pi^d(140)},\, \hat{I}_{\eta(549)},$$

$$\hat{I}_{K^+(494)},\, \hat{I}_{K^0(498)},\, \hat{I}^{d}_{K^{+d}(494)},\, \hat{I}_{K^{0d}(958)}\Big). \tag{11.41}$$

where the scholars not expert in the field should be aware of the use of the *isodual conjugation is necessary for neutral (as well as charged)antiparticles*, and represented with the symbol d.

The multi-valued (mv) image $\hat{SU}(3)_{mv}$ of the $SU(3)$ symmetry characterized by hyperunit (11.41) can be easily proved to be isomorphic to the conventional symmetry. Consequently, this hyperlifting preserves all results of the conventional $SU(3)$ classification by adding at the same time important hidden degrees of freedom to achieve compatibility with structure models (11.40).

11.13. Verification via the Isoscattyering Theory of Hadronic Mechanics. Following decades of research as above outlines, the author realized to be still far from representing sequence (11.32) since that sequence requires a nonunitary generalization of the relativistic scattering theory. Its construction required additional years of research that eventually led to the publications of Refs. [72] authored by the Italian-American physicists R. M. Santilli and the Afro-American physicist A. O. E. Animalu.

Since sequence (11.32) is *reversible over time,* the appropriate treatment emerged as being that via the *isoscattering theory* with a non-unitary Lie-isotopic structure (paper III of Refs. [72]). the more general *genoscattering theory* with a Lie-admissible structure (Paper IV of Refs. [72]) emerged as being necessary for the consistent treatment of high energy, inelastic, thus irreversible scattering events.

A main implication of these studies is that of Figure 9, namely, that *the notion of interaction via particle exchange, which has been so effective for electromagnetic interactions, is no longer valid for scattering at a sufficient high energy for a number of reasons, such as: the hyperdense nature of the scattering region preventing any effective particle exchange; the "contact" character of the ensuing interactions for which non exchange is possible; the mutation of the intrinsic characteristic of the scattering particles; etc,*

Consequently, a main prediction of the scattering theory of hadronic mechanics is that *the inclusion in the scattering theory of contributions from the irreversible character of high energy inelastic even ts implies the impossibility for the Higgs boson (also called 11God's particles: by organized interest in the field) "cannot exist."*

The implications of the scientific obstructions experience by the author from his Jewish colleagues at Harvard University, reported in Ref. [14] and documented in detail in the three volumes of Ref. [15], is therefore the apparent waste of trillions of public funds because, in the event Santilli's Lie-admissible studies had been honored at Harvard Uni-

versity under DOE support, the lack of possible existence of the Higgs boson would have been known decades before the construction of the large hadron collider at CERN.

Such huge implications are always inevitable whenever society allows organized interests to oppose the achievement of new scientific knowledge for blatantly evil and asocial personal gains.

11.14. Verification via the synthesis of Neutrons Inside Stars. By recalling that stars initiate their lives as an aggregate of hydrogen atoms, E. Rutherford submitted in 1919 the hypothesis that the proton and the electron coalesce into a new neutral particle he called the *neutyron* according to the synthesis

$$p^+ + e^- \to n, \tag{11.42}$$

Rutherford hypothesis on the existence of the neutron was subsequently confirmed in 1932 by J. Chadwick.

However, the apparent violation of the conservation of the angular momentum by synthesis (11. 42) did not escape the attention of W. Pauli who suggested the addition of a hypothetical neutral and massless particles in the above reaction to achieve the needed conservation law.

E. Fermi adopted Pauli's comments and suggested the names *neutrino* (meaning "little neutron" in Italian) with symbol ν that was conjectured to have mass zero, charge zero, and spin 1/2 resulting in the celebrated reaction that initiated the field of weak interactions

$$p^+ + e^- \to n + \nu \tag{11.43}$$

with complementary decay

$$n \ \to \ p^+ + e^- + \bar{\nu} \tag{11.43}$$

where $\bar{\nu}$ is the *antineutrino.*

The Italian-American scientist R. M. Santilli has spent decadfes of his research for systematic mathematyical, theoretical anbd experimental stujdies on the synthesis of the neutron inside a star

studies on the synthesis of the neutron inside a star, which studies required structural advances in mathematics, theoretica;l physics and experimental physics. To avoid a prohibitive length, in this section we can only review the most essential aspects.

An excellent comprehensive review hjas been recently provided by the Ukraine physicist I. Gandzha and the Geogian physicist J. Kadeisvili in their monographh [7xxx].

12.14A. Inapplicability of Quantum Mechanics for the Neutron Synthesis. The first and perhaps the most fundamemntal point identified by Santilli in Ref. [5b] of 1978 is that Pauli and Fermi did succ eed in salvaging the conservation of the angular momentu,m with their conjecture of a hypothetical particle, *but they failed to salvage the applicability of quantuym mechanics toi the neutron synthesis from a hydrogen atom.*

This is due to the fact that, as it was the case for the synthesis of the π^0 meson from an electron and a positron outlined in Section 11.12, in the synthesis of the neutron from a

proton and an electron the rest energy of the resulting state is *bigger* than the sum of the rest enmergies of the constituents,

$$E_n = 939.565\,\mathrm{MeV},\ E_p = 938.272\,\mathrm{MeV},\ E_e = 0.511\,\mathrm{MeV},$$

$$\Delta E = E_n - (E_p + E_e) = +0.782\,\mathrm{MeV} > 0. \qquad (11.xx)$$

Under these conditions, Schrödinger equation becomes inconsistent since it would require a "positive binding energy" which is anathema for quantum mechanics.[34] Additionally, again as it was the case for the synthesis of the π^0, the m issing $0.782\ MeV$ cannot be provided by the relative kinetic energy of the original particles, since at that energy teh cross section between protons and epectrons is of the order of $10^{-29}\ barn$, thus exclusing any realistic possibilty for their synthesis.

11.14b. Appicability of Hadronic Mechanics for the Neutron Synthesis. Hadronic mechanics is the *only* theory that has provcided a numerically exact representation of the *totality* pof the characteristics of the neutron in its synthesis inside a star (and not just the representation of the rest energy out of a classification spectrum with otehr particles).

In actuality, the 1978 proposal [5b] to construct hadronic mechanics was precisely center in the need to achieve a quantitative representation of the synthesis of the neutron via its most fundamental assumption of hadronic mechanics (hm), that of constgituting a *nonunitary covering of quantum mechanics* (qm). In fact, the first and only available representation of *all* characteristics of the neutron in its synthesis from a proton and an electron was achieved at the non-relativistic level in Ref. [xxx] of 1990 of 1993 via a non-unitary lifting of the Schëdinger equation for the hydrogen atom (ha)

$$\mathrm{ha} = (p^+,\, e^-)_{qm} \Rightarrow n = (\hat{p}^+,\, \hat{e}^-)_{\mathrm{hm}} = U[(p^+,\, e^-)_{qm}]U^\dagger,$$

$$UU^\dagger \neq I, \qquad (11.xx)$$

The relativistic representation of *all*— characteristiucs in the neutron synthesis was first achieved in paper [xxx] of 1995 via a non-unitary covering of Dirac's equation.

11.14c. The physical Constituents of the Neutron. The proton and the electron are the *only* permanently stable massive particles existing in the universe. Therefore, Santilli never accepted the conjecture implicit in the standard model according to which the proton and the electron "disappear" in synthesis (11.xx) to be replaced by the hypothetical and not directly detectable quarks and, additionally, in the spontaneous decay of the neutron (11.xx) the proton and the electron mysteriously "reappear" because of academic *fiat.*

Consequently, Santilli assumed the most plausible view that *the proton and the electron are the physical constituents of the neutron.* However, a first yhear graduate student can

[34]Serious scholars are strongly recommended to pick upo the Schödinger equation for the hydrogen atom and attempt tyhe achievement of any physically meaningful solution by turning the notoriously negtative Coulombb potential into a positi ve form.

easily prove that the physical characteristics of the proton and the electron as occurring when a member of the hydrogen atom leads to major inconsisten cies when equally used for the structure of the neuitron.

Therefore, Santilli argued that, in tyhe transition from, the conditions in the structure of the hydroigen atom to that of the neutron, the proton and the eletcron perform the transition from isolated conditions at alrge mutual distances to conditions of total mutual immersions that necessarily imply the mutyation of their intrinsic characteristics in to tyhe $isoproton\, \hat{p}^+$ and the $isoelectron\, \hat{e}^-$,

$$p^+ \ \rightarrow \ \hat{p}^+, \ \ e^- \ \rightarrow \ \hat{e}^-, eqno(11.xx)$$

resulting in *Santilli structure model of the neutron with physical constituents*

$$n = (\hat{p}^+, \hat{e}^-)_{hm} \qquad (11.xx)$$

At any rate, the ,mutations (11.xx) are necessary under the non-unmitary charactyer of the structure.

More technically, the proton and the electron as popularly assumed in the 20th century physics are irreducible unitary representations of the Poincaré symmetry. By contrast, *the isoproton and the isoelectron are non-unitary irreducible isorepresentations of the Lorentz-Poincaré-Santilli isosymmetry* under which the mutation of the intrinsic characteristics for rrest energy, magnetic moment, etc. are unavoidable (see Section xxx).

the scientiofic obnscurantis,m in the fiueld is set by the *unspoken* fact that quarks are needed by organized academic, financial and Jewish intyerests to maintain the dominance of Einstein';s theories in hadron physics since they are assyumed to be point-like. Santilli has always denounced this posture because, even assuming that quarks exist, and even assuming that they have a point-like charge (as it is the case indeed for the electron), *there exist no point-like wavepackets in nature.* Consequently, to be the constituents of hadrons, the hypothetical quarks must be in a condition to total mutual immersion, resulting in unavoidable non-0linear, non-local and non-potential interactions under which the assumption of the validity of Einsteinian theories is a political farse.

the organized scientific obscurantism in the field is finally sealed in history oif one meditate a moment on the fact indicated earlier, namely, that *quarks are what they are technicalkly, that is, mathematical representation ofc a purely mathe,matyivcal internal symmetry defined on a purely mathematical complex valued space that have no change of bneing technicalkky defined in oujr spacetime.*

The technically established impossibility of even defin ing quiarks ion our spacetime than established the organized politiucal character of their assumption as physical constituents of the neutron.

11.14D. The Spin of the Neutron as a Hadronic Bound State of a Proton and an Electron. During Pauli's and Fermi's time, the only possible treatment of the proton was that poermitted by quantum mechanics, namely, its abstractionm as a point-like particle. The emergence of the neutrino conjecture was then unavoidable with no alternative.

However, the proton is far from being point like in nature and, as a matter of fact, the proton has the charge radius of about $1\ fm$ which is quitge large for p[article standards. One of the most important implications of the novel mathematics underlying the isotopic branch oif hadronic mechanics, *Santilli isomathematics,* is that of permitting the representation of the proton as an *extended, generally non-sphgerical and deformable particle.*

The moment we admit the physical reality of the extended character of the proton, its synthesis from a proton an d an electron changes dramatically because the electron must be totally immersed in its interior. But the proton has a hyperdense medium in its interior, Consequently, the sole possibilikty for a consistent hadronic bound state is that *the electron must penetrate within the proton in a singlet coupling, and be carried along by the much heavcier proton with an angular momentum $j_{\hat{e}}$ equal to the proton spin,* as illustrated in Figure xxx.

It then follows that *the total angular momentum of the electron when compressed inside the proton is identically null, and (in first non-0relativistic approximation) the spin of the resulting neutron is identical to the spin of the proton,*

$$s_{\hat{e}} + j_{\hat{e}} = 0,$$

$$s_n = s_{\hat{p}} + s_{\hat{e}} + j_{\hat{e}} \equiv s_p. \qquad (11.xx)$$

In other words, a crucial implication in the transition from the representation of the proton as a point-like particle to its treatmnent as an extended particle is *the appearance of the angular momentum of the electron compressed inside the proton which si completely absent in the firmer case.*

However, as one can see, Rutherford's compression of the electron inside the hyperdense proton implies that *the (iso)-electron has hald-odd-integer eigenvalues,* which is anathema for quantum mechanics. In fact, the orbital eigenvalue $j = 1/2$ causes the violation of causality and other known quantum mechanical inconsistencies. This is precisely the reason that, following the formulation of the basic laws of hadronic mechanics in 1978, Santilli was in condition tlo stujdy the synthesis of the neutron only in 1990 [xx] due to tyhe need for the prior systematic study of the isotop;ic lifting of the SU(2)-spin symmetry.

In this way, Santilli first established that the isosymmeyry $]hatSU(2)$ does indeed achieve a fully c ausal description of half-odd-integer angular momenta, and onlyu thereafetr he was in a position to study the synthesis of the neutron inside a star. REatehr significantly, the known reason for the lack pof admission of half-odd-integer angular momen ta in quantum mechanic is precisely that they require a non-unitary structure, which is precisely the structure of the $\hat{SU}(2)$-spon isosymmetry.

11.14.xx. The Etherino vs the Neutrino hypothesis. The biggest obstacle for the achievement of a quantitative reporesentation of the synthesis of the neutron inside a star via the Pauli-Fermi reaction Eq. (11.xx), is that *the hjypothetical neutrino is placed in the r.h.s. of the equation, while the missing particle should have been placed in the l.h.s in order to provide not only the missing spin, but also the missing energy of* $0.782\ MeV$*).*

It sholuld be noted in particular that the comjugate reaction

$$p^{+}+\bar{\nu}+e^{-}\ \rightarrow\ !n, eqno(11.xx)$$

has no physical send for the synthesis of the neutron since the antineutrino has a well known, essentially null cross section with the proton anmd the electron, thius escluding any possible xchange of spin or otehr physical quantities.

Additionally, by recalling that stars must first synthesize the neutron as a condition to synthesize the deuteron and all pother known elements, and that only the latetr synthgesis are esoenergetic since the former is endoenergetic, Santilli noted in Ref. [xxx] that, *in the event the missing energy for the neutron synthesis is provided by the environm ent, a star would never initiate producing light because thety would "lose" energy at the rate of* $10^{30}\ MeV$ *per seconds.*

Consequentlym Santilli major contribution for the synthesis of the neutron inside a star is the identification of the fact that, by far, tyhe biggest mystery is the identification of the origjn of the mikssing energy, the Pauli-Fermi problem of the origin of the spin being targinal and easily explainable via the orbital angular momentum of the electron compessed inside the proton.

The only plausivble, or otherwise conceivable solution of the above myustery identified by Santilli following years of research is that *the missing* $0.782\ MeV$ *missing in tyhe synthesis of the neutron inside a star are provdied by the ether as a universal substratum with extremely high energy density* according to a massless and chargless impulse called *etherinon* and denoted with the letetr a from the Latin *aether*, according to the reaction

$$p^{+}+a+e^{-}\ \rightarrow\ n, eqno(11.xx)$$

The evident impl;icvation of teh above veiw is that *the neutriono does not exist as a [physical particle in our spacetime* without nbecessarily dismissing neutrino detections (suchb as thsoe of Ref. [70]) that may eventually result in being detections of the transfer form the etehr to our world of energy and otehr physical chgaracteristics.

In particularly, Santilli has shown [xx] tyhat *as an eim,pulse propagating throgh the etehr, the etherino cannot possib;ly be a transversa;l wave, and musty necvessarily be a longitudinal wave with very long wavelengthg, thus with veryu high speed.*

in the second part of the 20th century, the hypothesis of the neutrino and antineutrino were subjected to a chain of sequenial enlargments in order to achieve compatibility with the standard model of elementary particles, including:

1) The conjecture of the existence of three neutrinos (the electron, muon and tau neitronos) and the corresponding antineutrinos, although without a clearly identified differentiations in our spacetime;

2) The furtehr conjecture that the above six neiutrinos and antineutrinos have "flavor," but abain without a pclear physical differentiations;

3) The furtehr conjecture that thjis now large family of neiutroinos have masses;

4) The yet additional conjecture that "neutrino oscilate," namely, they transform themselves from one mode to another althoughwithout a clear explanation of the mechanism of transition; and

5) A number of conjectures that are implicit in the precveding ones, such as the fact that neutral but massive neutrino traverse entire planets and stars in extremely alrge numbers ()from the very large number of neutron synthesis in a star) with extremely small collisions.

In view of the uneasiness created by the above chain of conjectures, the author had dedicated decades of his research life to achieve a quantitative representation of the synthesis of the neutron in a star. The first aspect identified by the author following months of failed attempts while at MIT in the mid 1970s is that the Schrödinger equation cannot provide any physically meaningful representation of the synthesis of the neutron from a hydrogen atom because the rest energy of the neutron is [it bigger than the sum of the rest energies of the proton and electron

$$m_p = 938.272\ MeV,\ \ m_e = 0.511\ MeV,\ \ m_n = 939.565\ MeV, m_{\nu,e} =?, \qquad (11.xx)$$

$$m_n - (m_p + m_e) = 0.782\ MeV. \qquad (11.xx)$$

In this case Schröodinger equation no longer provdie physically meaningful solution due to the need for a "positive" binding energy which is anathema for quantum mechanics, as it was the case for the synthesis of mesons outlined in the precveding section.

Consequently, when at harvard University under DOE support, the authorsubmitted in the two memors [5a,5b] ofg 1978 the nonunitary covering of quantum mechanics known as *hadronic mechanics* for the specific purpose of achieving a quantitative representation of the neutron synthesis.

The motivation for the study was, and remains, the fact that *the neutron is the largest reservoir of clean energy available to mankind,* because it decays sponatmneous (when isolated) in 15 minutes with the release of a highly energetic electron potentially usable for energy source (pl;us the hypothetical neutrino that is environmentally harmless).

Apparently, the reason for the interest by the Department of "Energy" on Santilli's research in the neutron synthesis at harvard University was precisely the expected implications for new clean energies. the argument was, and remains, that, since the neutron is naturallu unstablr., it could admit *stimulated decay* with the production ofg clean energuy once, and only once we achieve a quantitative representation of its original synthesis.

Since the proton and the electron are the only permanently stable clearly icentified particles in the universe Santilli rejected the view by quark supporters according to which, in the synthesis of the neutron protons and electrons "disappear" 9sic) in bthe synthesis of the mneutron to be replaced by hypothetical quarks and, subsequently, in the neutron decay the proton and the electron "reappear" (sic).

under these unrassuring assumptiuons, Santilli adopted the more plausible veiw that *the proton and the electron are tyhe actual physical constituents of the neutron, of course, in a mutyated form caused by the total mutial penetration under the laws of the covering hadronic mechanics.*

The knowledge of hadronic mechanics achieved in its original proposal of 1978 was sufficient to work out imn details the structure model of mesons with real physical constituents outline in the preceding section, but said 1978 knowledge was insufficient to

achieve a quantitative representation of the neutron synthesis (11.xx) due to tyhe anomalous occurrence for tyhe spin.

In afct, teh quantitatyive treatment of tyhe $hadronic\ spin,$ here intended for the spin of a particle in total immersion within a hyperdense hadronic medium required poer se decades, first, for the non-0unitary liftiung oif Lie's theory, and then for the study of the isotopiuc $SU(2)$ spin briefly outlined in Section 8.

Finally, in 1990 to author had achieved sufficient maturity to reelase a first paper on the nonrelativistic hadronic treatment of the neutron synthesis, ref. [73].

XXX CONCLUDING REMARKS

in thsi way, a trend has been sealed in historyu according to which, whenever an uthoritative soucvr announces the surpassing of Einsteinian theories, organized academic, financial and Jewish interest immediately react to disqualify the ersults via the abuse of academic power, as it has been the case for:

1) The termination of Halton Arp at Harvard University by the Juwish Physicist I. Shapiro, S. Cole,man and optehrs following his measurements of connected quasars and galaxies with dramatically different cosmologicl redshift, following ASrp's refusal to dismiss the results, and the following with the well known and dpocumented prohibition for Arp to be admitted by all astropphysics laboratories in the world, thus attensting the capoillary organizations of said evil interests;

2) The prohibition of G. Rauch, Director of the Atom Institute in Wien, Austria, to access his neutron spectroscopic laboratrory in Grenove, Francem and elsewhere the moment he announced preliminary measurement of the deformability of neutrons under intense nuclear field, due to the evident breakdown of Einstein';s theories, despite the necessity of such deformations to reach an exact representation of nuclear magnetic moments;

3) The commissioning of the counter-experiments by N. Grossman oof the preceding measureemnts by H. Aronson showingh deviatiosn from Einstein;'s theories in the interior of hadrons via the measureemnts of trhgeir anomalous behaviouyr with speed, where the word "commissioning" is established by the extrimely effimer claims oof recovering exact Einsteinian theories thjat are violated byu the slightestchange in rmornalizations, form factor, expansions, and the like.

4) The termination by the Jewish physicists S. Weinberg., S. Glashow and S. Coleman of the administration by Harvbard University of DOE research grants to R. M. Santilli immediately following the knwoeldge of their surpassing Einstein's theoreis for inmterior dynamical problems [5], thus opposing $de\ facto$ the will of the United SDtates Goivernment, as established by the fact that three additional grantys were givcen by the DOE to R. M. Santilli under a different administraiton when he left Harvard University;

5) The granting in 2011 of the Nobel Prize in Physics to the Jewish physicist S. Perlmutter and otehrs for the "discovery," accpording to the official release by the Npobel Foundation, of the acvceleration of the universe [49], when such an acceleration si ingherent in the Hubble laws, thus voiding any possibility of seious novelty, a Nobel Prize

granted following the widespread knowledge of the dismissal of the expansion as well as of its acceleration by Refs. [37,38];

and otehr similar occurrences.

Due to the lack of identifying,. let alonbe resolving the amobe manipulations of basic physical knwoeldge by organized interests on Einstein doctrines, ut is evident to seripous scholars that vwe are eyewithnessing the biggest scientific obscurantis,m in human history, with no clu as to whetehr and whehn it will be halted.

Appendix A: IsoGravitation.

TO BE EDITED

10.8. IsoGravitation. While special relativity has no gravitational contemnt, as well know, this is not the case for the covering isorelativity due to unrestricted functional dependence of the isometric $\hat{\eta} = \hat{T}(x, ...)\eta$, as a result of which the isometric admits as [particular case all infinitely possible Riemannian metrics $g(r) \equiv \hat{\eta}$. The resulting treatment of gravitation has is today known as $IsoGravitation$ (IG).

The transition from the conventional to the isotopic formulation of gravity is provided by the following steps first proposed in Ref. [44] of 1994

I) Factorizing any possible (nonsingular, pseudo-) Riemannian, Finslerian, or other metric $g(x, ...)$ into the $Minkowskian$ metric η and a 4×4 matrix $\hat{T}_{gr}(x, ...)$,

$$g(x, ...) = \hat{T}_{gr}(x, ...) \times \eta, \tag{2.33}$$

II) Introducing the $gravitational\ isounit$ as the $inverse$ of the matrix $\hat{T}_{gr}(x, ...)$,

$$\hat{I}_{gr}(x, ...) = \hat{T}_{gr}(x, ...)^{-1}. \tag{2.34}$$

III) Reconstructing the Minkowskian geometry, the LP symmetry and special relativity with respect to the above gravitational isounit.

Since $\hat{T}_{gr}(x, ...)$ is necessarily positive-definite for all nonsingular Riemannian, Finslerian or other metrics in $(3 + 1)$-dimensions, the resulting LPS isosymmetry is isomorphic to the conventional LP symmetry, thus allowing the treatment of gravitation with all the formulations studied so far in these papers, as well as those we shall study in the future. The resulting formulation of gravity is today known as $Santilli\ isogravitation.$

As an illustration, the celebrated Schwarzschild line element in the coordinates (θ, ϕ, r, t) admits the following $identical$ reformulation as the isometric in isospacetime

$$ds^2 = r^2(d\theta^2 + sin^2 d\theta^2 + d\phi^2) + (1 - \frac{2 \times M}{r})^{-1} \times dr^2 -$$

$$-(1 - \frac{2 \times M}{r} \times dt^2 \equiv \hat{T}_{sch} \times \eta \equiv \hat{\eta}, \tag{2.35}$$

with *gravitational isounit and isotopic element*

$$\hat{T}_{sch} = Diag.[1, 1, (1 - \frac{2 \times M}{r})^{-1}, (1 - \frac{2 \times M}{r})], \tag{2.36a}$$

$$\hat{I}_{sch} = Diag.[1, 1, (1 - \frac{2 \times M}{r}), (1 - \frac{2 \times M}{r})^{-1}], \tag{2.36b}$$

where one should note the positive-definiteness of the gravitational isounit and we assume the reader is aware from Paper I of the need for isotrigonometry in the isotopic reformulation, hereon tacitly assumed.

The implications at large of the above formulation of gravitation are far reaching, and their specializations to scattering processes should be at least summarily outlined here due to their significance, such as the clear prediction presented in Paper III that very high energy scattering experiments can indeed generate mini-black-holes.

Let us begin our short outline with the following important

LEMMA 2.5.1 [40,44]: The isotopic reformulation of the Riemannian gravitation implies the loss of curvature in favor of the isoflatness of the Minkowski-Santilli isogeometry.

This fundamental result can be seen in a variety of ways, e.g., from the fact that, by conception and construction outlined in Section 2.2, the Minkowski-Santilli isogeometry is locally isomorphic to the *Minkowski* geometry, thus prohibiting any conventional notion of curvature. Alternatively, one can see the loss of curvature on a conceptual basis by noting that gravitation is entirely contained in the isotopic element $\hat{T}_{gr}$. Consequently, the deformation of the Minkowski metric caused by gravitation

$$\eta \ \rightarrow \ \hat{T}_{gr} \times \eta = \hat{\eta}, \tag{2.37}$$

is compensated by the *inverse* deformation of the unit

$$I = Diag.(1, 1, 1, 1) \ \rightarrow \ \hat{I}_{gr} = (\hat{T}_{gr})^{-1}, \tag{2.38}$$

without altering the original flatness in view of the novel isodilation symmetry of the Hilbert space, Eq. (3.19) of Paper I, the new isodilation invariance (2.18), or the very structure (2.9) spacetime invariants. In turn the loss of curvature in favor of isoflatness has the following implications rather important for scattering processes:

2.5.5A) **Consistent operator form of gravitation.** As it is well known, a consistent operator formulation of the Riemannian gravitation acceptable by the scientific community at large has not been achieved in one century of efforts due to unsurmontable problematic aspects or sheer inconsistencies caused by curvature, the ensuing nonunitary character of the theory, lack of the PCT theorem and other problems [48]. By comparison, isogravitation admits an axiomatically consistent operator formulation first achieved in ref. [44] merely given by embedding gravity in the *unit* of relativistic quantum mechanics,

thus preserving its abstract axioms, and ensuing consistency, including the correct formulation of the PCT theorem and all that. Note that this result *cannot* be achieved with the Riemannian curvature (see Ref. [16c] for details).

2.5.5B) **Universal invariance of gravitation.** As it is well known, the conventional Riemannian formulation of gravitation solely admits a '"covariance." But its structure is notoriously noncanonical, thus activating the theorems of catastrophic inconsistency (see Ref. [48] for details). By comparison, the isotopic formulation of gravity admits the universal LPS isoinvariance with the resolution of said inconsistency problems. Again, the reader should keep in mind that the invariance of gravitation is impossible with the Riemannian curvature (see Refs. [37.44.16c] for details).

2.5.5C) **Unification of the Minkowskian and Riemannian geometries.** Traditionally, the Minkowskian and Riemannian geometries are differentiated, as it should be, when formulated on conventional spaces over conventional fields. However, the use of isospaces over isofields has allowed the unification of these two geometries into one single geometry, the Minkowski-Santilli isogeometry, and their differentiation via different isounits first achieved in Ref. [40]. But the isometric $\hat{\eta}(x, ...)$ has an explicit dependence on coordinates and other variables. Consequently, the Minkowski-Santilli isogeometry admits the entire machinery of the Riemannian geometry., such as covariant derivative., Christoffel's symbols, etc. only isotopically reformulated, with consequential *geometric unification of special and general relativities.* This result has the consequence, rather important for scattering processes, according to which *the Einstein-Hilbert field equations are preserved and identically reformulated in an invariant operator version for the interior of the scattering region.* Note again that this result would be inconsistent under a Riemannian curvature on a number of grounds [48].

2.5.5D) **Isotopic grand unification.** It is equally well known that a grand unification of electroweak and gravitational interactions in a form acceptable by the scientific community at large has escaped all efforts beginning with Einstein. It is today known that the difficulties originate from: A) Inconsistencies in unifying a theory possessing an invariance with another theory solely possessing covariance (due to the activation by the latter of the inconsistency theorems for the entire unification [44]); B) Inconsistencies in unifying an operator theory on a flat spacetime with another on a curved spacetime (due to the ensuing nonunitary structure and activation, again, of the inconsistency theorems); and C) Inconsistencies in unifying a theory with full democracy between particles and antiparticles with a gravitational theory insufficient for the description of antiparticles. e/g/., without any distinction whatsoever between neutral particles and antiparticles (see Section 2.5). Thanks to the removal of curvature and the achievement of an invariant operator formulation, isogravity has resolved insufficiencies A, B, C, resulting in an axiomatically consistent *iso-grand-unification* in which gravitation is embedded in the unit of electroweak theories, first achieved in Refs. [45,46] (see monograph [15] for a comprehensive presentation including the necessary gravitational treatment of neutral or charged antimatter).

2.5.5E) **Interior gravitation.** As indicated in Paper I, prior to Einstein's time, there was a clear differentiation between exterior and interior problems. In fact, Schwarzschild wrote *two* papers, the first one for the *exterior gravitational problem* with his historical metric (2.35) and a vastly ignored second paper on the *interior gravitational problem.* The distinction between exterior and interior problems was then ignored for about one century via the abstraction of the latter problems to isolated point-particles in vacuum. The No Reduction Theorems reviewed in Paper I have suggested a return to the full differentiation between exterior and interior gravitational problems, thus relegating metric (2.35) to the meaning intended by its originator, namely, for the exterior problem only. The advent of isogravitation has permitted significant advances in interior gravitational; problems, e.g., by achieving for the first time a direct geometric representation (that is, a representation via the isometric) of the locally varying speed of light, the density of the interior medium and other features. Gravitational collapse is then represented with the *limit of null value of the space component of the isounit and the limit to a divergent value of its time component,* as geometrically expected in any case, i.e.,

$$\hat{I}^{int}_{gr,space}(x, v, \xi, \omega, \psi, \partial\psi, ...) \to \infty, \tag{2.39a}$$

$$\hat{I}^{int}_{gr,time}(x, v, \xi, \omega, \psi, \partial\psi, ...) \to 0. \tag{2.39b}$$

To understand the above reformulation of gravitational collapse, one should keep in mind that *isotopic rules (2.39) are equations that can be solved not only in the coordinates, as it is the case for the Schwarzschild metric (2.35), but also in the velocities and other variables as it is necessary for realistic models of interior gravitation.* The issue as to whether a true singularity such as the notion of *black hole,* is preserved by interior isogravitation, or we merely have a gravitational collapse without singularity, such as the notion of *brown hole,* is under study at this writing and the outcome will be reported in a future paper.

Acknowledgments.
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