Outline of the mathematical, physical and chemical discoveries of Prof. Ruggero Maria Santilli

EXECUTIVE SUMMARY.
The future and security of the United States of America crucially depends on the development of basically new technologies which, in turn, requires the development of basically new quantitative sciences. In this presentation, we indicate the historical successes as well as the limitations of 20th century sciences, and we outline the *New Sciences for a New Era* (see the general review [1] and the recent upgrade [2]) which were initiated in the 1970's by the Italian-American scientist, Ruggero M. Santilli [3], TEC Chief Scientist, when he was a Professor at the Department of Physics of Boston University under support from the USAFOSR, then continued when he was in the faculty of the Department of Mathematics of Harvard University under DOE support, and completed under support from U.S. Corporations thanks also to the participation of scientists the world over. We outline the rudiments of the new mathematical, physical and chemical formulations; we outline their experimental verifications in various fields; and we point out basically novel industrial applications under development by Thunder Energies Corporation. To avoid a prohibitive length of the bibliography accumulated in fifty years of research in the new sciences, we only quote originating works and primary independent reviews. An extended summary is available in Ref. [2].

1. ACHIEVEMENT AND LIMITATIONS OF 20TH CENTURY SCIENCES
The proper development of new technologies requires quantitative treatments, namely, formulations via equations that are first verified with experiment, and then applied of new problems. This approach has been used through centuries, resulting in mathematical, physical and chemical theories, hereon collectively referred to as "20th century sciences".

Despite advances of historical proportions, it is the fate of all quantitative sciences to admit limitations naturally emerging with the advancement of scientific knowledge. In fact, 20th century sciences have proved to be exactly valid for the so-called **exterior dynamical problems** generally referred to as point particle and electromagnetic waves propagating in vacuum thus solely experiencing action-at-a-distance, linear, local and potential interactions. The consistency can be traced down to the ultimate mathematical foundations of 20th century sciences, which is given by **Newton's (and Leibniz's) differential calculus** that can solely be defined at dimensionless points, as it is the case for the ordinary differential of a variable r and of the derivative of a function f(r)

$$dr, \quad df(r)/dt. \quad (1)$$

Despite its inception four centuries ago, the differential calculus has been kept essentially unchanged at the foundations of the 20th century most advanced possible quantitative treatments. For instance, despite their formulation on a Hilbert space, the Schroedinger and Heisenberg equations of quantum mechanics and chemistry crucially depend on Newton's differential calculus for their very expression.

Despite the indicated historical advances, 20th century sciences has shown clear limitations for the broader **interior dynamical problems** referred to as **extended particles** and electromagnetic waves propagating within physical media, as occurring in nature, thus experiencing conventional as well as contact, non-linear, non-local and non-potential interactions that are beyond any possible quantitative treatment via 20th century sciences for numerous technical reasons [1,2], thus mandating their generalization for the very future and security of America.

One illustration among many is given by the synthesis of the neutrons from the hydrogen atom occurring in the core of stars, which was first conceived by Rutherford [4] in 1910, experimentally verified by Chadwick [5] in 1932, and then studied by Fermi [6] and numerous other scientists

$$p^+ + e^- \quad n + \nu. \quad (2)$$
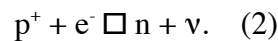
The inapplicability (and not the violation) of 20th century sciences stems from the fact that the mass of the neutron is 0.782 MeV *bigger* than the sum of the masses of the proton and of the electron, under which conditions quantum mechanics fails to produce any quantitative treatment at all. This is due to the fact that quantum mechanics was built for bound states whose mass is *smaller* than the sum of the masses of the original constituents, resulting in the known *mass defect* at the foundation of nuclear energies and weapons. By contrast, the neutron synthesis requires a *mass excess* under which the Schroedinger and Heisenberg equations have no physically meaningful solutions, thus mandating their generalization.

It should be noted that special relativity at large, and relativistic quantum mechanics in particular, did achieve historical results for the hydrogen atom, but they allow no quantitative treatment whatsoever for the synthesis of the neutron from the hydrogen. In fact, the Dirac equation fails to have any physical meaning under the mass excess condition requested for the neutron synthesis, thus requiring suitable generalization.

The insufficiency of 20th century sciences for the neutron synthesis (2) is the representation of the proton and the electron as massive points. Consequently, said insufficiency can be ultimately traced to the insufficiency for the neutron synthesis of Newton's differential calculus. In fact, the representation of the proton and the electron as massive points prevent any synthesis because the point-like electron cannot be evidently "compressed" inside the point-like proton according to Rutherford [4]. By contrast, the representation of the *"extended" shape and density* of the proton has permitted a quantitative representation of the neutron synthesis outlined below. This identifies the need of generalizing 20th century sciences in such a fashion to provide a representation invariant over time of the dimension and density of particles under the most general known interactions.

Recall the nuclear weapons that emerged from the *mass defect* of quantum mechanical fusions. To understand the implications of the needed generalizations of 20th century sciences, the reader should be made aware that the *mass excess* inherent in the neutron synthesis has basically novel industrial applications because the neutron synthesis is the most industrial synthesis in nature.

2. ISO-, GENO-, AND ISODUAL MATHEMATICS
The following generalized mathematics has been constructed over decades for the quantitative treatment of interior dynamical systems that cannot be sufficiently or consistently treated with 20th century mathematics:

2.1. ISOMATHEMATICS. Which is a covering of 20th century mathematics, thus admitting the latter as a particular case, for the quantitative representation of a system of extended particles under conditions of mutual penetration, as it is the case for the neutron synthesis, thus experiencing conventional as well as non-linear, non-local and non-potential interactions. The new mathematics is based on the following three central steps:

STEP 1: The central assumption of isomathematcs is the generalization of the conventional associative product AB between *all* possible quantities A, B (such as numbers, functions, matrices, operators, etc.), into the axiom-preserving, thus isotopic product first introduced in Harvard's works [7-9] of the late 1970's and today known as *Santilli isoproduct*

$$A*B = ATB, T = T(r, p, \mu, \psi, ...) > 0, \quad (3)$$

where the quantity T , called the *isotopic element,* is solely restricted by the condition of being positive-definite but possesses otherwise an arbitrary functional dependence on all needed local quantities such as coordinates r, momenta p, density μ, wavefunction ψ, etc. . The following simple realization of T

$$T = Diag. (a, b, c, d) Exp(\Gamma(\psi. ...), \quad (4)$$

readily allows, for the first time in history, the needed representation of the dimensions and density of particles, where a, b, c (normalized to the values a = b = c = 1 for the sphere) represent the shape and dimension of particles (here assumed to be spheroid charge distributions with semiaxes a, b, c), and where d represents the particle density (normalized to the value d = 1 for the vacuum).

Recall that 20th century physical and chemical theories are based on Lie's theory with product [A, B] = AB - BA. To illustrate upfront the far-reaching implications of isomathematics, note that isoproduct (3) implies a necessary generalization of the entire Lie theory into the covering Lie-Santilli isotheory [7-9] with isoproduct [A, B]' = A*B - B*A = ATB - BTA, and consequentially generalized physical and chemical theories.

STEP 2: To achieve consistency, the new mathematics must be formulated on generalized numeric fields F'(n',*, U) with basic unit, numbers and products first introduced in Ref. [10] of 1993 and called *Santilli isofields*

$$U(r, p, \psi, ...) = 1/T > 0, n' = nU, n'*m' = (nm)U, \quad (5)$$

which verify the axioms of a field, n' being *Santilli isoreal, isocomplex and isoquaternionic numbers*. Since all quantifies must be defined on an isofield, the only admissible variables are *isovariables* r' = rU, and the only admissible functions are the *isofunctions of an isovariable* f'(r') = [f(rU)]U. The non-linearity of the new mathematics is then clearly expressed by the arbitrary functional dependence of the new unit U.

STEP 3: Recall that Newton's differential calculus solely holds for numbers with constant trivial unit 1. Since isomathematics holds for a generalized unit U with an arbitrary functional dependence, Newton's differential calculus is no longer applicable in favor of the generalized calculus introduced in memoir [11] of 1996, today known as *Santilli isodifferential calculus*, with novel *isodifferential of an isovariable and isoderivative of an isofunction*

$$d'r' = Td[rU((r, ...)] = dr + r TdU, \quad (6)$$

$$d'f'(r')/d't' = U df'(r')/dt'. \quad (7)$$

To illustrate the fundamental, character of the new calculus, it should be indicated that it requires a compatible generalization of all 20th century quantitative treatments and that all new applications indicated below crucially depend on the extra term "rTdU" of Santilli's isodifferential calculus.

Isomathematics can be defined as being a generalized mathematics based on Steps 1, 2, 3, as well as the compatible generalization of the totality of the remaining aspects of 20th century mathematics with no known exception, thus including isofields, isofunctional analysis, isodifferential calculus, iso-Euclidean, iso-Minkowskian and iso-Riemannian geometries, Lie-Santilli isotheory with product [A,]' = ATb - BTA, isotopology, etc. A good introductory presentation of isomathematics for physicists and chemists remains the original memoir, while comprehensive presentations are available in monographs [12,13]. Mathematical presentations are available in the Ph. D. Course on isomathematics [14], as well as in the vast additional literature presented below.

It should be noted that the isoproduct ATB has no time direction and the Lie-Santilli isoproduct is invariant under time reversal (realized via anti-Hermiticity), $[A, B]' = - [A, B]^{\dagger}$, as it is also the case for 20th century mathematics. Consequently, 20th century mathematics and isomathematics can be consistently applied solely to systems invariant under time reversal, such as the structure of the hydrogen atom and its synthesis into the neutron. However, nature at large, and all energy releasing processes are irreversible over time, thus requiring the following irreversible generalization of isomathematics for their consistent treatment.

2.2. GENOMATHEMATICS. In order to achieve a mathematics with time irreversibility embedded in its basic axioms, Santilli constructed a covering of isomathematics in which *all* isoproducts A*B are ordered to the right A>B = ARB, resulting in the *forward genomathematics* for the representation of motion forward in time. Separately, *all* isoproducts A*B are ordered to the left A<B = ASB, resulting in the *backward genomathematics* for the representation of motion backward in time. The first known axiomatically consistent representation of energy releasing processes is then assured when the R≠S. Another way to see the structural irreversibility of genomathematics is by noting that *Santilli Lie-admissible theory* at the foundation of genomathematics with product (A, B) = A<B - B>A = ARB - BSA is not invariant under time reversal, $(A, B) \neq - (A, B)^{\dagger}$. Genomathematics was initiated by Santilli, in paper [15] of 1967, and then continued in various works [16-21]. Comprehensive presentations of genomathematics are available in Refs. [1, 2, 12, 13[with upgrade [21], as well as in the additional references quoted below.

2.3. HYPERMATHEMATICS. Then preceding mathematics are single-valued in the sense that products yield one single result. Santilli has shown that single-valued mathematics are insufficient for the representation of biological structures, such as the DNA, due to their complexity. In order to resolve this insufficiency, Santilli introduced what is considered nowadays the broadest mathematics that can be conceived by the human mind consisting of multi-valued, irreversible hyperformulations defined on a hyperfield]11-13] in which a hyperproduct AhB can yield 10^{30} results because needed to initiate the understanding of the DNA code.

2.4. ISODUAL MATHEMATICS. Conventional, isotopic and genotopic mathematics solely apply for the description of matter and cannot be consistently used for antimatter since the latter requires a new anti-Hermitean mathematics as a necessary condition to represent matter-antimatter annihilation (see Section 4 of Ref. [2]). Since studies on antimatter have shown scientific and industrial values, Santilli constructed the needed new mathematics for antimatter under the name of *isodual mathematics* which is essentially given by an anti-Hermitean image of the totality of 20th century mathematics, thus including the basic unit, numbers, functions, differential calculus, etc. It then follows that isodual mathematics is based on the unit "-1" whose negative value is necessary for the causal treatment of the negative energy of antimatter originally conceived by P. A. M. Dirac [22] in 1928. Isodual mathematics was introduced by Santilli, in paper [10] of 1993, then studied in numerous

4

works (see, e.g., [23-25]) and treated in detail in works [11-13]. A comprehensive treatment of isodual conventional, iso- and geno-mathematics is available in monograph [26] of 2006. A list of references is also available in Ref. [27].

2.5. HADRONIC MATHEMATICS is the collection of conventional, iso-, geno- and hypermathematics for matter and their isoduals for antimatter [13]. A 50 page long bibliography on the various branches of hadronic mathematics is available in Ref. [28] of 2008, with upgrades in Refs. [1,2]. Among such a vast literature, we note in particular monographs [29-34]. Particularly significant, is the series of six monographs [35] by Svetlin Georgiev of the Department of Mathematics of the Sorbonne University, Paris, on the isodifferential calculus illustrating its vast implications.

3. ISO-, GENO-, ISODUAL MECHANICS AND CHEMISTRY

Being a theoretical physicist, Santilli constructed the above chain of generalized mathematics for the specific objective of constructing the following generalized physical and chemical theories as for the consistent treatment of time reversible and irreversible interior dynamical systems.

3.1. ISOMECHANICS, which is given by an axiom-preserving lifting of quantum mechanics solely treatable via isomechanics in all its aspects [12] (see Refs. [1,2] for reviews). By ignoring advanced mathematical treatments, isomechanics can be readily constructed via the following steps:

STEP 1: Assume the following non-unitary realization of the isounit in representation of short-range non-linear, non-local and non-Hamiltonian interactions

$$U = W\,W^\dagger = 1\,/\,T = = Diag.\,(n_1{}^2, n_2{}^2, n_3{}^2, n_4{}^2), \quad (8)$$

where the n-characteristic quantities are assumed to contain the multiplicative exponential term of Eq. (5), under the condition that U ≈ 1 at mutual distances much bigger than one Fermi. Note that the above realization will change from case to case.

STEP 2: Apply the above transform to the "totality" of the Hilbert space formalism, including: Planck's constant (h = 1), numbers, operators, states, expectation values, etc.,

$$1' = W\,1\,W^\dagger = U, \quad n' = W\,n\,W^\dagger = nU, \quad A' = W\,A\,W^\dagger, \quad A'*\,B' = W\,(AB)\,W^\dagger, \quad (9a),$$

$$|\psi'\rangle = W\,|\psi\rangle W^\dagger, \quad \langle\psi'|*\,A'*\,|\psi'\rangle = W\langle\psi|\,A\,|\psi\rangle\,W^\dagger, \text{etc.}, \quad (9b)$$

by achieving in this way the background iso-Hilbert space over isofields. Lack of application of the above non-unitary transform to one single quantity of the Hilbert space formalism implies insidious inconsistencies that generally remain undetected by non-initiated colleagues.

STEP 3: Apply the same transform to the dynamical equations by reaching in this way the *Schroedinger-Santilli isoequation*

$$H' * |\psi'\rangle = H'(r', p')T(\psi'. ...) |\psi'\rangle = E'*|\psi'\rangle = E\,|\psi'\rangle, \quad (10)$$

the *isolinear isomomentum*

$$Wp|\psi\rangle W^\dagger = p'*|\psi'\rangle = \partial'_r|\psi'\rangle = U\partial_r|\psi'\rangle, \quad (11)$$

and the *Heisenberg-Santilli isoequation*

$$i'* d'A'/d't' = [A', H']^* = A'*H' - H'*A',   (12)$$

all basic dynamical equations being defined on the *Hilbert-Santilli isospaces* over an isofield. The above equations are at the foundation of *non-relativistic isomechanics*. They verify the superposition principle thus allowing for the first time in history a quantitative characterization of the constituents of bound states (such as nuclei) with conventional plus non-linear, non-local and non-potential internal interactions caused by mutual penetrations of charge distributions. All other aspects of isomechanics then follow uniquely and unambiguously. Quantum mechanics is recovered uniquely and unambiguously for U = 1. Particularly significant is the invariance of isomechanics under isounitary transforms, including the preservation of the numerical value of the isotopic element T (see the review in Ref. [2] Section 2). The best reference of isomechanics remains the 1995 Vol. II of [12].

Recall that an electron orbiting around the proton in vacuum can only experience discrete changes of its energy levels. By comparison, it should be noted that *Santilli isomechanics is based on the generalization of Planck's constant h into the integro-differential operator* U. This lifting is necessary for interior dynamical systems because the energy exchange of an electron in the core of a star cannot possibly be discrete due to the extreme values of the local density and pressure. It should be also noted that isomechanics eliminates the divergencies of quantum mechanics because it turns divergent conventional series into convergent isoseries due to very small values of the isotopic element T. For this reason, isomathematics is particularly suited to accelerate computations.We note, from its very construction, that *Santilli isomechanics is a non-unitary "completion" of quantum mechanics according to the 1035 argument by Einstein, Podolsky and Rosen*. In fact, it should be noted from Refs. [7-9 that the sole possibility for a quantitative representation of the "mass excess" of the neutron synthesis is that via a non-unitary generalization of Schroedinger equation, as illustrated in the next section. *Relativistic isomechanics* is the non-unitary generalization of relativistic quantum mechanics characterized by isomathematics. Its most important dynamical equation is the non-unitary isotopic generalization of Dirac equation which plays a fundamental role for the relativistic treatment of the neutron synthesis [1,2,12,13,37].

3.2. GENO- AND HYPER-MECHANICS, is given by the generalization of isomechanics characterized by genomathematics, thus implying the difference of the modular action to the right, H>|ψ'> = HS|ψ'> from its time reversal image <ψ'|<H = <ψ'|RH, thus assuring irreversibility. It should be indicated that the use of genomechanics is crucial for the consistent quantitative treatment of all energy releasing processes, including weapons, due to new contributions caused by irreversibility that simply do not exist in isomechanics or quantum mechanics [1,2,12,13,21]. Hypermechanics is a covering iof genomechanics in which the genounit has an arbitrary *(ordered) number of values.

3.3. ISODUAL MECHANICS, it is the anti-Hermitean image of quantum mechanics used for point-like antiparticles, while the isodual isomechanics and isodual genomechanics are suited for interior antimatter problems at large [26]. HADRONIC MECHANICS is the collection of all above indicated mechanics, including quantum, iso- and geno-mechanics for matter and their isoduals for antimatter [12,13] [1,2,12]. HADRONIC CHEMISTRY is the reformulation of quantum chemistry via iso- and geno-mechanics including quantum, iso- and geno-chemistry for matter and their isoduals for antimatter [138,39].

3.4. HADRONIC MECHANICS is the collection of conventional, iso- , geno- and hyper-mechanics for matter and their isoduals for antimatter [13].

3.5. ISO=. GENO-, AND HYPER-RELATIVITIES, special relativity and its underlying structure, including the homogeneous and isotropic Minkowski space $M(x, \eta, I)$ with spacetime coordinates x, metric $\eta = \text{Diag}(1, 1, 1, -1)$, unit $I = \text{Diag}(1, 1, 1, 1)$, and the universal Lorentz-Poincare' symmetry, have been proved by experiments conducted over one century to be exactly valid for point-like particles and electromagnetic waves propagating in vacuum (exterior dynamical problems). Conceptual, theoretical and experimental evidence also accumulated over one century have established that special relativity is inapplicable (rather than violated) for extended particles and electromagnetic waves propagating within generally inhomogeneous and anisotropic physical media (interior dynamical problems) [1,2,12.13].

Santilli has conducted comprehensive studies for the construction of a covering of special relativity applicable to time reversible interior dynamical problems, today known as *isorelativity,* including the isotopies of every possible aspect of special relativity [40-52] then the formulation of the basic axioms [53], the extension of the results to gravitation [54,55] and the experimental verifications reviewed below (see the independent reviews [56,57[). Isorelativity is based on the *Minkowski-Santilli isospace* $M'(x', \eta', U)$ with isocoordinates $x' = xU$, isometric $\eta' = T\eta$, isounit (8), and isoinvariant

$$x'^{2'} = (x^\mu \, T_\mu{}^\varrho \eta_{\varrho \, v} \, x^v) \, U =$$

$$= (x_1{}^2/n_1{}^2 + x_2{}^2/n_2{}^2 + x_3{}^2/n_3{}^2 - t^2 \, c^2/n_4{}^2) \, U, \qquad (13)$$

with universal isosymmetry first identified in Ref.[44] of 1983, today known as *Lorentz-Santilli isosymmetry*

$$x'^1 = x^1, \quad x'^2 = x^2, \qquad (14a)$$

$$x'^3 = \gamma' \, (x^3 - \beta \, x^4), \qquad x'^4 = \gamma' \, (x^4 - \beta' \, x^3), \qquad (14b)$$

$$\beta = v/c, \quad \beta' = (v/n_3) \, / \, (c/n_4), \quad \gamma' = (1 - \beta'^2)^{-1/2}. \qquad (14c)$$

All applications for reversible interior dynamical problems presented in this outline are based on Santilli isorelativity which has achieved, for the first time in history, the invariance of locally varying speeds of light

$$C = c/n_4 = C(t, r, p, \mu, \psi \, ... \qquad (15)$$

In particular, all applications are realizations of the isoaxioms such that are uniquely and unambiguously characterized by the Lorentz-Poincare'-Santilli isosymmetry, as [2,53]: 1) The generalized equivalence principle

$$E' = mc^2 = mC^2 = mc^2/n_4{}^2 = E/n_4{}^2, \qquad (16)$$

2) The generalized time dilation law

$$t' = t\gamma' = t[1 - V/C)^2]^{-1/2} = t[1 - (vn_4/cn_3)^2]^{-1/2}; \qquad (17)$$

3) The generalized Doppler's effect

$$\Delta\omega \approx \pm \, v/c \pm Kd, \qquad (18)$$

where ; $\pm$ v/c is the conventional Doppler effect solely due to relative motion and $\pm$ Kd is a basically new effect characterized by the loss of energy by light to a cold medium (minus sign) or the acquisition of energy by light

from a hot medium (plus sign), d representing the distance covered by light in the medium considered, and K being a rather complex quantity which can be averaged in first approximation to a constant depending on density, temperature, chemical composition and other features of the medium.

GENO- AND hyper-RELATIVITIES are coverings of isorelativity, for the representation of single-valued and multi-valued irreversible systems characterized by geno- and hyper-mathematics, respectively [2,12,13]. ISODUAL RELATIVITIES are the isodual images of the preceding relativities for antimatter[26].

4. EXPERIMENTAL VERIFICATIONS

4.1. VERIFICATION IN WATER. In order to achieve compatibility with special relativity, a light beam propagating in water is reduced to photons scattering in vacuum among water molecules. However, such a reduction has been proven not to allow a quantitative representation of the angle of refraction, as well as the reduction of light speed by 1/3, not to mention the very propagation of the light beam with minimal dispersions. Additional insufficiencies originate from Electron traveling in water faster than c, the violation of the axioms of relativistic sum of speeds and other problems. Finally, the reduction to photons becomes manifestly inapplicable for infrared and radio waves with large wavelengths that experience exactly the same phenomenology as that of other frequencies. This diversified evidence establishes beyond credible doubt the inapplicability of special relativity in water with evident implication of its inapplicability in all other physical media treated below. The new sciences specifically built for dynamics within physical media, such as isomathematics, isomechanics and isorelativity, have resolved the insufficiencies of special relativity in water thanks to the achievement of the invariance of the locally varying speed of light, Rq. (15) (see Section 2 of Ref. [2] with particular reference to Figures 4, 5 and Section 2.14).

4.2. VERIFICATION WITH THE NEUTRON SYNTHESIS. Isomathematics, isomechanics and isorelativity have permitted, the first known numerically exact and time invariant representation of *all<* characteristics of the neutron (rest energy, charge radius, spin, anomalous magnetic and moment, mean life) in its synthesis from the hydrogen atom in the core of stars at both the non-relativistic [58,59] and relativistic [60,61] levels. The mechanism for the representation of the 0.782 MeV "mass excess" of synthesis (2) is provided by Santilli's isodifferential calculus that, in turn, characterizes the increase of the rest energy of the electron from 0.511 MeV in vacuum to 1.252 MeV when the electron is compressed in the hyperdense proton, thus allowing an exact analytic solution much along the original study [8] for the synthesis of the π^0 meson from the stable particles emitted in the spontaneous decay with the lowest mode, an electron-positron pair. Following, and only following the achievement of a representation of the neutron synthesis from the hydrogen, Santilli conducted systematic tests and achieved for the first time in history, first, the laboratory synthesis of the neutron, and then its industrial production [62-71].

4.3. VERIFICATIONS WITH THE TIME BEHAVIOR OF UNSTABLE HADRONS. The only known way for deviations from special relativity in the hyperdense interior inside hadron to manifest in the outside is via deviations from Einstein's time dilation law. This prediction can be experimentally tested via the behavior of the mean life unstable hadrons with speed. . An experiment was conducted by Aronson et al in 1983 [72] which established deviation from Einstein's time dilation for Kaons energies ranging fro 10 GeV to 100 GeV. A counter-experiment was conducted by Grossman et al in 1987 [73] by claiming the validity of special relativity for Kaons although for the *different* energy range from 100 GeV to 400 GeV, which validity continues to be assumed by orthodox academia to this day for all energies. In 1989, Aringazin [74] proved that Santilli's time isodilatation law (17) contains as particular cases all possible generalizations of Einstein's law in a symmetric spacetime. The subsequent studies [75-77] have established the exact validity of isolaw (17) for the numerically

exact and time invariant representation of all experimental data [72,73]. Proposals to FERMILAB, CERN, DESY and other laboratories to repeat the test from 1o GeV to 100 GeV have been discredited.

4.4. VERIFICATION IN THE BOSE-EINSTEIN CORRELATION. It is generally believed in academia that special relativity is exactly valid for the Bose-Einstein correlation. In reality, the representation of experimental data requires four arbitrary parameters while only *two* arbitrary parameters can be introduced with ad hoc manipulations of relativity axioms. Hence, the missing two parameters are direct evidence of deviations from special relativity in the hyperdense interior of the proton-antiproton fireball. Isorelativity has achieved a numerically exact and time invariant representation of the experimental data of the Bose-Einstein correlation from un-adulterated axioms *without* any arbitrary parameters, via the three values of the semiaxes of the proton-antiproton fireball plus its density [78,79].

4.5. VERIFICATIONS WITH NUCLEAR MAGNETIC MOMENTS AND SPINS. It is generally believed in academia that relativistic quantum mechanics is exactly valid for nuclear strictures and reactions even though said theory has been unable to achieve in one century of efforts the exact representation of nuclear magnetic moments, nuclear spins, nuclear forces, and other basic nuclear data. The origin of these insufficiencies is the abstraction by special relativity of nucleons as massive points, while nuclei are composed by extended and hyperdense nucleons in conditions of partial mutual penetration causing non-linear, non-local and non-potential interactions beyond any hope of quantitative treatment via 20th century sciences. Following the development of isomathematics, isomechanics and isorelativity for extended, thus deformable nucleons, Santilli has achieved the first known exact representation of the magnetic moments of stable nuclei [37,80,81]. Subsequently, Bhalekar and Santilli achieved the same exact representation for the spin of all stable nuclei [82], thus confirming that relativistic quantum mechanics is not exactly valid for the nuclear structure in favor of suitable covering vistas.

4.6. VERIFICATIONS WITH NUCLEAR FUSIONS WITHOUT NEUTRONIC RADIATIONS. It is generally believed that relativistic quantum mechanics is additionally exact for nuclear reactions in general, and nuclear fusions in particular, even though the former is reversible over time while the latter are not. Following the development of irreversible formulations, including genomathematics, genomechanics and genorelativity. Santilli predicted [83] the existence of nuclear fusions at intermediate energies of light natural elements into light natural elements without the emission of harmful neutronic radiations and without the release of radioactive waste, today known as *Intermediate Controlled Nuclear Fusions* (ICNF) or "warm fusions" for short, which are solely possible under the engineering realization of a number of *hadronic laws for nuclear fusions* [84]. Following these original proposals, Santilli conducted systematic experimental verification that established indeed the existence of ICNF without the emission of neutronic radiation and without the release of radioactive waste, among which we indicate the ICNF of 1-D-2 and 6-C-12 into the stable 7-N-14, that of 6-C-12 and 8-O-16 into the stable 14-Si-28, that of the oxygen molecules (2 x 8-O-16) into the stable 16-S-32, and others (see Refs. [84-114] that include signed analytic reports and independent conformations)

4.7. VERIFICATIONS IN OUR ATMOSPHERE. In order to maintain the validity of special relativity in our atmosphere, it is generally believed that the redness of the Sun at Sunset is due to the absorption of blue light by our atmosphere. However, such a view violates the well-known physical law according to which the absorption of light by a gas is proportional to its wavelength. In fact, red light is already absorbed by the relatively short travel of light when the Sun is at the Zenith. Therefore, red light cannot possibly survive the 6,000 km travel of light in our atmosphere at Sunset. Isorelativity predicted in 1991 [53] the existence of a non-Doppler red- and blue-shift of light propagating in transparent media, known as *Santilli IsoRedShift (IsoBlueShift)*, and consisting of light losing energy to (acquiring energy from) a cold (hot) medium in accordance with isoaxiom (18).

Systematic experiments conducted in the U.S.A. as well as in Europe have confirmed the existence of Santilli isoshifts, first, for individual laser light and secondly for Sun light [116-101].

4.8. VERIFICATIONS IN COSMOLOGY. Einstein, Hubble, Hoyle, Zwicky, Fermi and other famous scientists opposed the conjecture of the expansion of the universe because the representation of Hubble law for the cosmological redshift, z - Hd, via the Doppler axiom of special relativity, $z = Hd = v/c$, implies that **all galaxies at the same distance d from Earth have the same cosmological redshift in all radial directions from Earth,** thus implying a return to the Middle Ages with Earth at the center of the universe. The crucial words "in all radial directions from Earth" are generally omitted to maintain special relativity in cosmology. Numerous additional inconsistencies also occur for 20th century cosmological conjectures. Santilli isoredshift is a direct experimental verification on Earth of Zwicky 1929 hypothesis of the "Tired Light". Vast mathematical, theoretical and experimental studies have then confirmed: the dismissal of the expansion of the universe; the dismissal of the acceleration of the expansion; the dismissal of the expansion of space itself (!!); the dismissal of the big bang; the dismissal of dark matter; and the dismissal of dark energy [120-124].

4.9. VERIFICATIONS IN MOLECULAR STRUCTURES. The 20th century chemical notion of valence bond at the foundation of the notion of molecules does not constitute a quantitative model because it lacks a treatment via equations predicting an attractive force which is compatible with experiments. Additionally, according to quantum mechanics and chemistry, **valence electrons should repel, and certainly not attract each other since they have the same charge.** Isomechanics and isochemistry have resolved this insufficiency by achieving a quantitative representation of valence electron bonds in singlet having a clearly attractive force which has been proved to be consistent with experimental data on molecular structures [38,125,126] for which discovery Santilli has been recommended to the Nobel Prize in physics and, separately in chemistry [127].

4.10. VERIFICATIONS WITH A NEW CHEMICAL SPECIES. Following, and only following, the achievement for the first time in history of a quantitative representation of molecular structures thanks to a clearly attractive valence bond, Santilli achieved in the same memoir of 1998 [128] the theoretical prediction and experimental verifications of a new chemical species, today known as *Santilli magnecules*, consisting of atoms bonded together by opposing magnetic polarities of toroidal polarization of atomic orbits (see Refs. [129-145]). A primary feature of Santilli magnecules is that of having a chemical bond *weaker* than that of conventional molecules as a condition to allow complete combustion, that is, combustion without combustible contaminants in the exhaust.

4.11. VERIFICATION WITH NEW FUELS WITH INCREASED ENERGY OUTPUT. A most important application of the new chemical species of magnecules is that of new fuels with magnecular structure such as magnegas (see the general presentation [146] and U. S. patents [147,138]) which have an increased combustion energy compares to a magnecular fuel with the same atoms [149]. A flame temperature more than double that of any commercially available fuel [150,151] and combustion exhaust without measurable CO as well as appreciable hydrocarbons [152]. An important class of fuels with magnecular structure is given by *Santilli magnehydrogen (chemical symbol MH) and magneoxygen (chemical symbol MO)* [153] which can be, at the atomic level, as pure hydrogen and oxygen, respectively, yet their specific weight is a multiple of their conventional molecular value, thus resulting in increased trust, increased liquefaction temperature, increased reactivity and other distinct features [154-157].

4.12. VERIFICATIONS WITH MAGNEHYDROGEN AND MAGNEOXYGEN. Important magnecular fuels are given by new forms of hydrogen and oxygen called Santilli MagneHydrogen (chemical symbol MH) and MagneOxygen (Chemical Symbol MO) consisting of gases that, at the atomic level are as pure hydrogen and oxygen as desired, yet their specific weight is a multiple that of conventional H2 and O2, thus implying an

increased trust, higher liquefaction temperature and other distinct advantages with respect to H2 and O2 [153-156].

4.13. VERIFICATION WITH ANTIGRAVITY AND GEOMETRIC PROPULSION. One of the most important implications of the isodual theory of antimatter is the confirmation of matter-antimatter gravitational repulsion (antigravity) at *all* possible levels, including Newtonian mechanics, analytic mechanics, quantum mechanics, Minkowskian geometry and Riemannian geometry [26,157-159]. Santilli conducted comprehensive studies on the experimental verification of the indicated type of antigravity, including the proposal to test the comparative gravity of electrons and positrons in horizontal flight in a supercooled and supervacuum tube [160], which experiment has been defined by experts in the field to be resolutory because the comparative displacement of electrons and positrons with milli-eV energy in a scintillator at the end of a 10 m supervacuum and supercooled tube is visible to the naked eye [161-167]. The rigorous treatment of antigravity experienced by antimatter in the field of matter has permitted Santilli to provide a mathematical formulation of the new isogeometric propulsion which is a non-Newtonian propulsion based on the local change of the geometry of spacetime caused by antimatter, thus essentially permitting arbitrary trajectories, such as sharp changes of directions and acceleration, including motion through matter (see Section 4.3.3 of Ref. [26]).

4.14. VERIFICATION WITH ANTIMATTER GALAXIES. The experimental verification of Zwicky hypothesis on the Tired Light and the consequential elimination of the expansion of the universe imply a return to a stationary universe supported by Hubble, Hoyle, Einstein and others. Yet, a stationary universe should have collapsed a long time ago due to the gravitational attraction among galaxies. The sole known way to achieve the stability of the universe is that of assuming the existence of antimatter galaxies [168] whose existence is confirmed by past devastation of Earth that can be solely explained quantitatively due to antimatter asteroids that can indeed impact on Earth despite matter-antimatter gravitational repulsion [169]. In view of these occurrences, Santilli conducted systematic, mathematical, theoretical, experimental and industrial studies for the detection of antimatter galaxies we cannot possibly review here in details [170-189]. We merely mention the prediction that antimatter emits a new light called *isodual light of the first kind* with negative index of refraction and negative energy [170]. Images composed by such a new light can solely be detected via telescopes with *concave lenses*. today known as *Santilli telescopes* [171,172]. Following the construction of numerous telescopes, Santilli first detected in 2014 [173,174] an antimatter galaxy in the Vega region of the night sky, which detection was independently confirmed in Refs. [175,176], and then a second antimatter galaxy, this time in the Capella region of the night sky [177] (see also Refs. [178-185]).

4.15. VERIFICATIONS VIA NEW FORMS OF INVISIBILITY. Santilli's isoblueshift (Section 4.6) allows a new form of invisibility achieved by a craft surrounded by a plasma of such temperature to shift visible light to ultraviolet frequencies. The same isoblueshift also allows maintaining communications with crafts surrounded by plasmas due to friction with air via the search for properly shifted frequencies. These communications have not been achieved to date because of the intent of achieving compatibility with special relativity since such a theory prohibits any frequency shift. In his studies of antimatter, Santilli has discovered a second new light permitting invisibility called *isodual light of the second kind* which can be emitted by matter-crafts, thus having conventional positive energy, yet the index of refraction is negative, thus being totally invisible to the naked eye, as well as to any Galileo-type optical instrument on Earth or in space due to their convex lenses [186-188].

5. INDUSTRIAL APPLICATIONS

5.1. ISOCRYPTOGRAMS consisting of cryptograms formulated via Santilli isomathematics (Section 2), thus being characterized by isounits whose arbitrary value can be changed automatically every second so as to require infinite time for their resolution (See Vol. I of Ref. [12]).

5.2. DETECTION OF SMUGGLED NUKES. Following decades of mathematical, theoretical and experimental studies reported in Sections 2, 3, and 4.2, the U. S. publicly traded company *Thunder Energies Corporation* (stock symbol TNRG) has initiated production and sale of *Directional Neutron Sources,* DNS, also called The Neutron Gun - namely, equipment producing on demand a predominantly directional flux of low energy neutrons which is ideally suited to scan suitcases, containers or grounds for the detection of possible concealed nuclear weapons or fissionable materials. the same DNS is particularly suited for the identification of precious metals and their concentrations in mines, to test large naval welds, and other applications.

5.3. MODULATORS OF LASER LIGHT. We are here referring to equipment capable of increasing or decreasing a laser light (Section 4.7), which equipment is under consideration for production and sale by Thunder Energies Corporation.

5.4. MAGNECULAR FUELS WITH COMPLETE COMBUSTION. Basically, new fuels achieving complete combustion, that is, without combustible contaminants in the exhaust (Section 4.11), have been in production and sale for several years by the U. S. publicly traded company *Magnegas Corporation* (stock symbol MNGA).

5.5. HYPERCOMBUSTIONS AND HYPERFURNACES. Thunder Energies Corporation is currently developing a basically new, combustion at high temperature triggered by high voltage rapid DC discharges having a first enhancement of the energy output due to full combustion (Section 4.11) and a second enhancement of energy output due to Intermediate Controlled Nuclear Fusions (ICNF), such as that o9f Carbon and Oxygen into Silicon (Section 4.6).

5.6. DETECTION OF ANTIMATTER GALAXIES. Santilli telescopes with concave lenses for the detection of antimatter galaxies are in production and sale by Thunder Energies Corporation (Section 4.14 and Section 4 of ref. [2]).

5.7. COMPLETE SURVEILLANCE EQUIPMENT. Surveillance equipment currently available solely detect visible light. Following Santilli's discovery of the new isodual light with negative index of refraction Thunder Energy Corporation is producing and selling pairs of 70 mm, 100 mm, 150 mm and 200 mm Galileo and Santilli telescopes equipped with digital cameras that can scan the totality of all detectable, conventional and isodual light for the surveillance of civilian, industrial and military installations.

REFERENCES
http://www.
All quoted references have active links for direct view.

References

[1] I. Gandzha and J. Kadeisvili, *New Sciences for a New Era: Mathematical, Physicaland Chemical Discoveries of Ruggero Maria Santilli,* Sankata Printing Press, Nepal(2011),
http://www.santilli-foundation.org/docs/RMS.pdf

[2] R. M. Santilli, 11An introduction to the new sciences for a new era," R. M. Santilli, "An introduction to new sciences for a new era" Invited paper SUPS 22016,Hinan IUsland, China, Clifford Analysis, Clifford Algebras and their Applications
http://www.santilli-foundation.org/docs/new-sciences-new-era.pdf

[3] R. M./ Santilli, Curriculum
http://www.i-b-r.org/Ruggero-Maria-Santilli.htm

[4] H. Rutherford, *Proc. Roy. Soc. A* **97**, 374 (1920) [1a];

[5] J. Chadwick, *Proc. Roy. Soc. A* **136**, 692 (1932) [1b];

[6] E. Fermi, *Nuclear Physics* (University of Chicago Press, 1949) [1d];

[7] R. M. Santilli, "On a possible Lie-admissible covering of Galilei's relativity in Newtonian mechanics for nonconservative and Galilei form-non-invariant systems,"Hadronic J. Vol. 1, 223-423 (1978),
http://www.santilli-foundation.org/docs/Santilli-58.pdf

[8] R. M. Santilli, "Need of subjecting to an experimental verification the validity within a hadron of Einstein special relativity and Pauli exclusion principle,"Hadronic J. Vol. 1, 574-901 (1978),
http://www.santilli-foundation.org/docs/santilli-73.pdf

[9] R. M. Santilli, *Foundation of Theoretical Mechanics,* Volume I [3a] (1978) and II [3b] (1982) Springer-Verlag, Heidelberg, Germany,
http://www.santilli-foundation.org/docs/Santilli-209.pdf
http://www.santilli-foundation.org/docs/santilli-69.pdf

[10] R. M. Santilli, "Isonumbers and Genonumbers of Dimensions 1, 2, 4, 8, their Isoduals and Pseudoduals, and "Hidden Numbers," of Dimension 3, 5, 6, 7," Algebras, Groups and Geometries Vol. 10, 273 (1993),
http://www.santilli-foundation.org/docs/Santilli-34.pdf

[11] R. M. Santilli, "Nonlocal-Integral Isotopies of Differential Calculus, Mechanics andGeometries," in Isotopies of Contemporary Mathematical Structures," RendicontiCircolo Matematico Palermo, Suppl. Vol. 42, 7-82 (1996),
http://www.santilli-foundation.org/docs/Santilli-37.pdf

[12] R. M. Santilli, *Elements of Hadronic Mechanics*, Vol. I and Vol. II (1995) [15b],Academy of Sciences, Kiev,
http://www.santilli-foundation.org/docs/Santilli-300.pdf
http://www.santilli-foundation.org/docs/Santilli-301.pdf

[13] R. M. Santilli, *Hadronic Mathematics, Mechanics and Chemistry*, Volumes I toV,International Academic Press, (2008),
http://www.i-b-r.org/Hadronic-Mechanics.htm

[14] Ph.D. Course on Isomathematics
http://www.i-b-r.org/scientific-rebirth-9.htm

[15] R. M. Santilli, "Embedding of Lie-algebras into Lie-admissible algebras,"NuovoCimento **51**, 570 (1967),
http://www.santilli-foundation.org/docs/Santilli-54.pdf

[16] R. M. Santilli, "Dissipativity and Lie-admissible algebras," Meccanica **1**, 3 (l969).

[17] R. M. Santilli, "An introduction to Lie-admissible algebras," Suppl. Nuovo Cimento, **6**, 1225 (1968).

[18] P. Roman and R. M. Santilli, "A Lie-admissible model for dissipative plasma," Lettere Nuovo Cimento Vol. **2**, 449-455 (l969).

[19] R. M. Santilli, *Lie-Admissible Approach to the Hadronic Structure,* Hadronic PressVol.I and II (1982),
http://www.santilli-foundation.org/docs/Santilli-71.pdf
http://www.santilli-foundation.org/docs/Santilli-72.pdf

[20] R. M. Santilli, "Invariant Lie-admissible formulation of quantumdeformations,"Found. Phys. **27**, 1159- 1177 (1997),
http://www.santilli-foundation.org/docs/Santilli-06.pdf

[21] R. M. Santilli, "Lie-admissible invariant representation of irreversibility formatterand antimatter at the classical and operator levels," Nuovo Cimento B121, 443(2006),
http://www.santilli-foundation.org/docs//Lie-admiss-NCB-I.pdf

[22] P. A. M. Dirac, Proceedings of the Royal Society 1928, **117,** 610624.

[23] R. M. Santilli, A Classical Isodual Theory Of Antimatter And Its Prediction Of Antigravity, International Journal of Modern Physics A, 14 (1999) 2205-2238,
http://www.santilli-foundation.org/docs/Santilli-09.pdf

[24] R. M. Santilli, "Representation of antiparticles via isodual numbers, spaces and geometries, " Comm. Theor. Phys. 1994 **3,** 153-181
http://www.santilli-foundation.org/docs/Santilli-112.pdf Antigravity

[25] R. M. Santilli, "A new cosmological conception of the universe based on the isominkowskian geometry and its isodual, Part I pages 539-612 and Part II pagesContributed paper in Analysis, Geometry and Groups, A Riemann Legacy Volume, Volume II, H.M. Srivastava, Editor, pp. 539-612 (1993)

[26] R.M. Santilli, *Isodual Theory of Antimatter with Applications t o Antigravity, GrandUnification and Cosmology,* Springer A2006),
http://www.santilli-foundation.org/docs/santilli-79.pdf

[27] Pamela Fleming, "Scientific references and PR Web News Releases on Santilli isodual Theory of Antimatter,"
http://www.santilli-foundation.org/docs/Santilli-Telescope-Refs-1-15.pdf

[28] P. Fleming, General Bibliography on Hadronic Mathematics, Mechanics andChemistry (2008),
http://www.santilli-foundation.org/docs/Santilli-64.pdf

[29] Chun-Xuan Jiang, *Foundations of Santilli Isonumber Theory,* International AcademicPress (2001),
http://www.i-b-r.org/docs/jiang.pdf

[30] D. S. Sourlas and G. T. Tsagas, *Mathematical Foundation of the Lie-Santilli Theory,* Ukraine Academy of Sciences (1993),
http://www.santilli-foundation.org/docs/santilli-70.pdf

[31] J. V. Kadeisvili, "An introduction to the Lie-Santilli isotopic theory," MathematicalMethods in Applied Sciences **19**, 1349 (1996),
http://www.santilli-foundation.org/docs/Santilli-30.pdf

[32] Chun-Xuan Jiang, *Foundations of Santilli Isonumber Theory,* International AcademicPress (2001),
http://www.i-b-r.org/docs/jiang.pdf

[33] Raul M. Falcon Ganfornina and Juan Nunez Valdes, *Fundamentos de la Isdotopia deSantilli,* International Academic Press (2001),
http://www.i-b-r.org/docs/spanish.pdf
English translations Algebras, Groups and Geometries Vol. 32, pages 135-308(2015),
http://www.i-b-r.org/docs/Aversa-translation.pdf

[34] Raul M. Falcon Ganfornina and Juan Nunez Valdes, "Studies on the Tsagas-Sourlas-Santilli Isotopology," Algebras, Groups and Geometries Vol. 20, 1 (2003),
http://www.santilli-foundation.org/docs/isotopologia.pdf

[35] S. Georgiev, *Foundations of t he IsoDifferential Calculus,* Volumes, A, AI, AII, AV and V, Nova Scientific Publisher A2015 An).

[36] Scientific archives of the R. M. Santilli Foundation
http://santilli-foundation.org/news.html

[37] R. M. Santilli, "Relativistic hadronic mechanics: nonunitary, axiom-preserving completion of relativistic quantum mechanics," Found. Phys. Vol. 27, 625-729
(1997),http://www.santilli-foundation.org/docs/Santilli-15.pdf

[38] R. M. Santilli, *Foundations of Hadronic Chemistry, with Applications to New CleanEnergies and Fuels,* Kluwer Academic Publishers (2001),
http: //www.santilli-foundation.org/docs/Santilli-113.pdf
Russian translation by A. K. Aringazin
http://i-b-r.org/docs/Santilli-Hadronic-Chemistry.pdf

[39] P. Fleming, Main references on hadronic chemistry
http://www.santilli-foundation.org/docs/refs-hadronic-chemistry-2015.pdf

[40] R. M. Santilli, "Rotational isotopic symmetries," ICTP communication
No.IC/91/261 (1991),
http://www.santilli-foundation.org/docs/Santilli-148.pdf

[41] R. M. Santilli, "Isotopies of Lie Symmetries," I (basic theory) and II (isotopies of therotational symmetry), Hadronic J. Vol. 8, 36 and 85 (1985),
http://www.santilli-foundation.org/docs/santilli-65.pdf

[42] R. M. Santilli, "Isotopic Lifting of the SU(2) Symmetry with Applications to NuclearPhysics," JINR rapid Comm. Vol. 6. 24-38 (1993),
http://www.santilli-foundation.org/docs/Santilli-19.pdf

[43] R. M. Santilli, "Isorepresentation of the Lie-isotopic SU(2) Algebra with Applicationto Nuclear Physics and Local Realism," Acta Applicandae Mathematicae Vol. 50,177 (1998),
http://www.santilli-foundation.org/docs/Santilli-27.pdf

[44] R. M. Santilli, "Lie-isotopic Lifting of Special Relativity for Extended DeformableParticles," Lettere Nuovo Cimento **37**, 545 (1983),
http://www.santilli-foundation.org/docs/Santilli-50.pdf

[45] R. M. Santilli, "Lie-isotopic Lifting of Unitary Symmetries and of Wigner's Theoremfor Extended and Deformable Particles," Lettere Nuovo Cimento Vol. 38, 509 (1983),
http://www.santilli-foundation.org/docs/Santilli-51.pdf

[46] R. M. Santilli, "Lie-isotopic generalization of the Poincare' symmetry, classical formulation," ICTP communication No. IC/91/45 (1991),
http://www.santilli-foundation.org/docs/Santilli-140.pdf

[47] R. M. Santilli, "Nonlinear, Nonlocal and Noncanonical Isotopies of the Poincare'Symmetry," Moscow Phys. Soc. Vol. 3, 255 (1993),
http://www.santilli-foundation.org/docs/Santilli-40.pdf

[48] R. M. Santilli, "Recent theoretical and experimental evidence on the synthesis ofthe neutron," Communication of the Joint Institute for Nuclear Research, Dubna, Russia, No. E4-93-252 (1993).

[49] R. M. Santilli, "Recent theoretical and experimental evidence on the synthesis ofthe neutron," Communication of the JINR, Dubna, Russia, No. E4-93-252 (1993),published in the Chinese J. System Eng. and Electr. Vol. 6, 177 (1995),
http://www.santilli-foundation.org/docs/Santilli-18.pdf

[50] R. M. Santilli, "Isominkowskian Geometry for the Gravitational Treatment of Matter and its Isodual for Antimatter," Intern. J. Modern Phys. D **7**, 351 (1998),
http://www.santilli-foundation.org/docs/Santilli-35.pdf

[51] R. M. Santilli, "Compatibility of Arbitrary Speeds with Special Relativity Axiomsfor Interior Dynamical Problems," American Journal of Modern Physics, in press(2016),
http://www.santilli-foundation.org/docs/ArbitrarySpeeds.pdf

[52] R. M. Santilli, "Lie-isotopic generalization of the Poincare' symmetry, classical formulation," ICTP communication No. IC/91/45 (1991),
http://www.santilli-foundation.org/docs/Santilli-140.pdf

[53] R. M. Santilli, *Isotopic Generalizations of Galilei and Einstein Relativities,* Vol. I(1991) [12a] and Vol. II (1991) [12b], Hadronic Press, Palm Harbor, Florida,
http://www.santilli-foundation.org/docs/Santilli-01.pdf
http://www.santilli-foundation.org/docs/Santilli-61.pdf

[54] R. M. Santilli, "Rudiments of IsoGravitation for Matter and its IsoDual for AntiMatter," American Journal of Modern Physics Vol. 4, No. 5, 2015, pp. 59, in the SpecialIssue I; *Foundations of Hadronic Mathematics,* Dedicated to the 80th Birthday of Prof. R. M. Santilli
http://www.santilli-foundation.org/docs/10.11648.j.ajmp.s.2015040501.18.pdf

[55] J. Feldman, "Debate on General Relativity,"
http://galileoprincipia.org/physics

[56] A. K. Aringazin, A. Jannussis, F. Lopez, M. Nishioka and B. Vel-janosky, *SantillisLie-Isotopic Generalization of Galilei and Einstein Relativities,* Kostakaris Publishers,Athens, Greece (1991),
http://www.santilli-foundation.org/docs/Santilli-108.pdf

[57] J. V. Kadeisvili, *Santilli's Isotopies of Contemporary Algebras, Geometries and Rela -tivities,* Ukraine Academy of Sciences, Second edition (1997),
http://www.santilli-foundation.org/docs/Santilli-60.pdf

[58] R. M. Santilli, Apparent consistency of Rutherfords hypothesis on the neutron as acompressed hydrogen atom, Hadronic J.13, 513 (1990),
http://www.santilli-foundation.org/docs/Santilli-21.pdf

[59] R. M. Santilli, Apparent consistency of Rutherfords hypothesis on the neutron struc -ture via the hadronic generalization of quantum mechanics -
I: Nonrelativistic treat-ment, ICTP communication IC/91/47 (1992)
http://www.santilli-foundation.org/docs/Santilli-150.pdf

[60] R. M. Santilli, Recent theoretical and experimental evidence on the synthesis of th eneutron, Communication of the Joint Institute for Nuclear Research, Dubna, Russi a, No. E4-93-252 (1993).

[61] R. M. Santilli, Redlativistic representation of the neutron synthesis from the hydro -gen Chinese J. System Eng. and Electr. Vol. 6, 177 (1995),
http://www.santilli-foundation.org/docs/Santilli-18.pdf

[62] R. Norman and J. Dunning-
Davies, "Hadronic paradigm assessed: neutroid andneutron synthesis from an a rc of current in hydrogen gas," Hadronic Journal V. 40,119 - 140 (2017),
http://santilli-foundation.org/docs/norman-dunning-davies-hj.pdf

[63] R. M. Santilli, "Confirmation of Don Borghi's experiment on the synthesis of neu -trons," arXiv publication, August 15, 2006
http://arxiv.org/pdf/physics/0608229v1.pdf

[64] R. M. Santilli, "Apparent confirmation of Don Borghis experiment on the laborator ysynthesis of neutrons from protons and electrons, Hadronic J. **30**, 29 (2007),
http://www.i-b-r.org/NeutronSynthesis.pdf

[65] R. M. Santilli, "New structure model of hadrons, nuclei and molecules," websit e http://www.neutronstructure.org
"Confirmation of Don Borghi's experiment on the synthesis of neutrons from pro -tons and electrons"
http://www.neutronstructure.org/neutron-synthesis.htm

[66] R. M. Santilli and A. Nas, "Confirmation of the Laboratory Synthesis of Neutron sfrom a Hydrogen Gas," Journal of Computational Methods in Sciences and Eng, 1 4(2014) 40541
www.thunder-energies.com/docs/neutron-synthesis-2014.pdf

[67] R. M. Santilli, "12 minutes Film on the Laboratory Synthesis of Neutrons from aHydrogen Gas"
www.world-lecture-series.org/newtron-synthesis-08-14

[68] . V. Kadeisvili, The Rutherford-Santilli Neutron," Hadronic J. Vol. 31, Number 1, pages 1-125, 2008,
http://www.i-b-r.org/Rutherford-Santilli-II.pdf
also available in in html format at
http://www.i-b-r.org/Rutherford-Santilli-neutron.htm

[69] Chandrakant S. Burande. "Santilli Synthesis of the Neutron According to HadronicMechanics," American Journal of Modern Physics 2016; 5(2-1): 17-36
http://www.santilli-foundation.org/docs/pdf3.pdf

[70] Richard Norman, Anil A. Bhalekar, Simone Beghella Bartoli, Brian Buckley, JeremyDunning-Davies, Jan Rak, Ruggero M. Santilli, "Experimental Confirmation of theSynthesis of Neutrons and Neutroids from a Hydrogen Gas, American Journal ofModern Physics, Vol. 6(4-1), page 85-104 (2017)
http://www.santilli-foundation.org/docs/confirmation-neutron-synthesis-2017.pdf

[71] Richard Norman, Anil A. Bhalekar, Simone Beghella Bartoli, Brian Buckley, JeremyDunning-Davies, Jan Rak, Ruggero M. Santilli, , Two minute minute movie on theoperation of the neutron source
http://thunder-energies.com/docs/MagnaPower.mp4
neutron counts per Seconds detected by the Ludlum detector model 375
http://thunder-energies.com/docs/Ludlum-Alarms.mp4
confirmation of such detection by the Berkeley Nucleonics SAM 940
http://thunder-energies.com/docs/Sam-Alarms.mp4
confirmation of neutron detectors by the Polimaster PM170
http://thunder-energies.com/docs/polimaster-reading.pdf

[72] S. H. Aronson et al., Phys. Rev. D 28, 495 (1983).

[73] N. Grossman et al., Phys. Rev. Lett. 59, 18 (1987).

[74] A. K. Aringazin, Hadronic J. 12 71 (1989).

[75] F. Cardone, R. Mignani and R. M. Santilli Lie-isotopic energy dependence of the KSlifetime, J. Phys. G: Nucl. Part. Phys. 18 [1992], L141-L152.

[76] F. Cardone and R. Mignani, Nonlocal approach to the Bose-Einstein correlation,Univ. of Rome Preprint No. 894, July 1992.

[77] Yu. Arestov, R. M. Santilli and V. Solovianov, "Experimental evidence on theisominkowskian character of the hadronic structure," Foundation of Physics Let-ters Vol. 11, pages 483-492 (1998)
http://www.santilli-foundation.org/docs/Santilli-52.pdf

[78] R.M. Santilli, "Nonlocal formulation of the Bose-Einstein correlation within thecontext of hadronic mechanics," Hadronic J. **15**, 1-50 and 81-133 (1992), http://www.santilli-foundation.org/docs/Santilli-116.pdf

[79] F. Cardone and R. Mignani, "Nonlocal approach to the Bose-Einstein correlation,Europ. Phys. J. C 4, 705 (1998). See also "Metric description of hadronic interactionsfrom the Bose-Einstein correlation," JETP Vol. 83, p.435 (1996), http://www.santilli-foundation.org/docs/Santilli-130.pdf

[80] R.M. Santilli, A quantitative isotopic representation of the deuteron magnetic moment, in Proceedings of the International Symposium Dubna Deuteron-93, JointInstitute for Nuclear Research, Dubna, Russia (1994),
http://www.santilli-foundation.org/docs/Santilli-134.pdf

[81] R.M. Santilli, Nuclear realization of hadronic mechanics and the exact representation of nuclear magnetic moments, R. M. Santilli, Intern. J. of Phys. Vol. 4, 1-70(1998)
http://www.santilli-foundation.org/docs/Santilli-07.pdf

[82] A.A. Bhalekar and R. M. Santilli, Exact and Invariant Representation of NuclearMagnetic Moments and Spins According to Hadronic Mechanics, American Journalof Modern Physics, 2016; 5(2-1): 56-118
http://www.santilli-foundation.org/docs/nuclear-MM-spins.pdf

[83] R.M. Santilli,*The Physics of New Clean Energies and Fuels According toHadronic Mechanics*, Special volume of the Journal of New Energy, 318pages (1998),
http://www.santilli-foundation.org/docs/Santilli-114.pdf

[84] R.M. Santilli. "The novel "Controlled Intermediate Nuclear Fusion:" A report onits industrial realization as predicted by hadronic mechanics," Hadronic J. **31**, 1,2008,
http://www.i-b-r.org/CNF-printed.pdf
http://www.i-b-r.org/CNF-printed.pdf

[85] R.M. Santilli, "Experimental Confirmation of Nitrogen Synthesis from deuteriumand Carbon without harmful radiations," New Advances in Physics 4, issue no.1,(2010
http://www.santilli-foundation.org/docs/Nitrogen-Synthesis-01-24-10.pdf

[86] R.M. Santilli, "Additional Confirmation of the "Intermediate Controlled Nuclear Fusions" without harmful radiation or waste," Proceedings of the Third

International Conference on the Lie-Admissible Treatment of Irreversible Pro-cesses, Kathmandu University (2011) pages 163-177 http://www.santilli-foundation.org/docs/ICNF-3.pdf

[87] R.M. Santilli, "Video presentation of the third hadronic reactor for the Nitrogen and Silicon syntheses."
http://www.world-lecture-series.org/dragon-iii

[88] R.M. Santilli, "Video on the Hadronic Reactor III for the synthesis of the Silicon,"
http://www.world-lecture-series.org/dragon-iii

[89] R.M. Santilli, "Sound of Intermediate Controlled nuclear syntheses."
http://www.santilli-foundation.org/Thunder-Fusions.amr

[90] R.M. Santilli, "Invariant Lie-Admissible Classical and Operator Mechanics for Matter, Lecture
http://www.world-lecture-series.org/level-iii

[91] R.M. Santilli, "Intermediate Controlled Nuclear Fusions without the emission of radiations and without the release of radioactive waste," Lecture
http://www.world-lecture-series.org/level-v

[92] R.M. Santilli, "Third Hadronic Reactor for Intermediate Controlled Nuclear Fusions without Radiations,"
http://www.world-lecture-series.org/level-v

[93] R.M. Santilli, "Introduction to Intermediate Fusions without Radiations," lecture delivered at the US-China Summit, October 30, 2011,
http://www.world-lecture-series.org/level-v

[94] D. Rossiter, Director, "IVA Report 184443 on comparative Nitrogen counts" (for Ref. [78]),
http://www.santilli-foundation.org/docs/IVA-Report-184443.pdf

[95] D. Rossiter, Director, "IVA Report 184445 on comparative Nitrogen counts on samples of the Nitrogen synthesis,
http://www.santilli-foundation.org/docs/Spectral-analysis-Ref-[79].png

[96] R. Brenna, T. Kuliczkowski and L. Ying, "Report on Test for Silicon" on the Nitrogen synthesis
http://www.santilli-foundation.org/docs/PGTI-Anal-test1.pdf

[97] D. Rossiter, Director, "IVA Report 189920 on comparative Silica counts,"
http://www.santilli-foundation.org/docs/IVAReport 189920.pdf

[98] D. Rossiter, Director, "IVA Report 189920 on comparative Silica counts," oxygen synthesis.www.santilli-foundation.org/docs/IVAReport 189920.pdf

[99] D. Rossiter, Director, "IVA Report 200010 on comparative Nitrogen counts. http://www.santilli-foundation.org/docs/Oneida-analyses-2013.zip

[100] D. Swartz, "Constellation Technologies first report on comparative Silica counts,"
http://www.santilli-foundation.org/docs/Constellation-Si-10-13.zip

[101] D. Swartz, "Constellation technologies second report on comparative Silica counts,"
http://www.santilli-foundation.org/docs/Constellation-Rep-Si-2.zip

[102] D. Swartz, "Constellation technologies Third report on comparative Silica counts,"
http://www.santilli-foundation.org/docs/Constell-Si-3.pdf

[103] A. Nas, "Data on Constellation technologies tests 1 and 2 on comparative Silica counts,"
http://www.santilli-foundation.org/docs/Data-Constell-tests.docx

[104] D. Swartz, "Constellation technologies Third report on comparative Silica counts,"
http://www.santilli-foundation.org/docs/Constell-Silicon-10-14.pdf

[105] A.K. Aringazin, "Toroidal configuration of the orbit of the electron of the hydrogen atom under strong external magnetic fields," Hadronic J. 24, 134 (2001),
http://www.santilli-foundation.org/docs/landau.pdf

[106] R. Brenna, T. Kuliczkowski, L. Ying, "Verification of Santilli intermediate Controlled Nuclear Fusions without harmful radiations a and the production of magnecular clusters," New Advances in Physics, **5**, 9 (2011),
http://www.santilli-foundation.org/docs/ICNF-2.pdf

[107] J. V. , C. Lynch and Y. Yang, "Confirmations of Santilli Intermediate Nuclear Fusions of Deuteron and Carbon into Nitrogen without Radiations." The Open Physical Chemistry Journal **5**, 17 2013,
http://www.santilli-foundation.org/docs/ICNF-Conf-2013.pdf

[108] L. Ying, W. Cai, J. , C. Lynch, S. Marton, S. Elliot and Y. Yang, "Experimental verification for Intermediate Controlled Nuclear Fusion," City College of New York Preprint, to appear,
http://www.santilli-foundation.org/docs/ICNF-Cai-paper-Ying.pdf

[109] Leong Ying, "Verification of Santillis Intermediate Nuclear Harmful Radiation and the Production of Magnecular Clusters," Lecture VD of the website
http://www.world-lecture-series.org/level-v

[110] Leong Ying, "Verification of Santillis Intermediate Nuclear Harmful Radiation and the Production of Magnecular Clusters Leong Ying," lecture
http://www.world-lecture-series.org/level-v

[111] R.B. Lanjewar, "A Brief Review of Intermediate Controlled Nuclear Syntheses (ICNS) without Harmful Radiations," AIP Conference Proceedings 1648, 510012

(2015); doi: 10.1063/1.4912717
http://www.santilli-foundation.org/docs/1.4912717(RB-Lanjewar).pdf

[112] I.B. Das Sarma, "Hadronic Nuclear Energy: An Approach Towards Green Energy,"
AIP Conference Proceedings 1648, 510008 (2015); doi: 10.1063/1.4912713
http://www.santilli-foundation.org/docs/1.4912713(IB-Das Sarma).pdf

[113] U. Abundo, "Interpretation n and enhancement of the excess energy of Rossi's re-
actor via Santilli neutroids and nucleoids," Hadronic Journal Vol. 37, pages 697-737
2014,
http://www.thunder-fusion.com/docs/abundo-paper-2014.pdf

[114] J. Pace, Chairman, World Lecture Series,
http://www.world-lecture-series.org/
Section V in particular
http://www.world-lecture-series.org/level-v

[115] R.M. Santilli, "Experimental Verifications of IsoRedShift with Possible Absence of
Universe Expansion, Big Bang, Dark Matter, and Dark Energy," The Open Astron-
omy Journal **3**, 124 (2010),
http://www.santilli-foundation.org/docs/Isoredshift-Letter.pdf

[116] R.M. Santilli, "Experimental Verification of IsoRedShift and its Cosmological Im-
plications," American Institute of Physics Conference Proceedings Vol. 1281, pp.
882-885 (2010),
http://www.santilli-foundation.org/docs/Santilli-isoredshift.pdf

[117] R.M. Santilli, "Experimental verifications of isoredshift with possible absence of
universe expansion, big bang, dark matter and dark energy," The Open Astronomy
Journal **3**, 124 (2010),
http://www.santilli-foundation.org/docs/Santilli-isoredshift.pdf

[118] R.M. Santilli, G. West and G. Amato, "Experimental Confirmation of the IsoRed-
Shift at Sunset and Sunrise with Consequential Absence of Universe Expansion
and Related Conjectures, " Journal of Computational Methods in Sciences and En-
gineering, Vol. 12, pages 165-188 (2012),
http://www.santilli-foundation.org/docs/Confirmation-sun-IRS.pdf

[119] G. West and G. Amato, "Experimental Confirmation of Santilli's IsoRedShift and
IsoBlueShift," contributed paper to the *Proceedings of the San Marino Workshop on
Astrophysics and Cosmology for Matter and Antimatter*, Republic of San Marino,
September 5 to 9, 2011, in press (2012),
http://www.santilli-foundation.org/docs/Confirmation-IRS-IBS.pdf

[120] H. Ahmar, G. Amato, J.V. Kadeisvili, J. Manuel, G. West, and O. Zogorodnia, "Ad-
ditional experimental confirmations of Santilli's IsoRedShift and the consequential

lack of expansion of the universe, "Journal of Computational Methods in Sciences and Engineering, Vol. 13, page 321 (2013),
http://www.santilli-foundation.org/docs/IRS-confirmations-212.pdf

[121] R.M. Santilli, "Representation of galactic dynamics via isoshifts without universe expansion, dark matter and dark energy," American Journal of Modern Physics Vol. 4, pages 26-43, 2015,
http://www.thunder-energies.com/docs/dark-matter-2015.pdf

[122] Interview of R.M. Santilli by the American Freedom Radio on the lack of expansion of the universe.
https://www.youtube.com/watch?v=bO91tUJfN24

[123] Interview of R.M. Santilli by the French Agence de la Recherche Scientifique on the lack of expansion of the universe.
http://www.i-b-r.org/Prof-Santilli-Interview.html

[124] P. Fleming, "Collected papers, interviews, seminars and international press releases on the lack of expansion of the universe."
http://www.santilli-foundation.org/docs/No-universe-expans.pdf

[125] R.M. Santilli and D. D. Shillady, "A new isochemical model of the hydrogen molecule," Intern. J. Hydrogen Energy Vol. 24, pages 943-956 (1999),
http://www.santilli-foundation.org/docs/Santilli-135.pdf

[126] R.M. Santilli and D. D. Shillady, "A new isochemical model of the water molecule," Intern. J. Hydrogen Energy Vol. 25, 173-183 (2000),
http://www.santilli-foundation.org/docs/Santilli-39.pdf

[127] J. Feldman, Chairman, Recommendation of Prof. R. M. Santilli to the Nobel Prizes in Physics and Chemistry.
http://nobelprizeweb.com

[128] R.M. Santilli, "Theoretical prediction and experimental verification of the new chemical species of magnecules," Hadronic J. 21, 789 (1998),
http://www.santilli-foundation.org/docs/Santilli-43.pdf

[129] M.G. Kucherenko and A.K. Aringazin, "Estimate of the polarized magnetic moment of the isoelectronium in the hydrogen molecule" Hadronic J. 21, 895 (1998),
http://www.santilli-foundation.org/docs/Kucherenko-1998.pdf

[130] E. Trell, "Review of Santilli Hadronic Chemistry," International Journal Hydrogen Energy Vol. 28, p. 251 (2003),
http://www.santilli-foundation.org/docs/Trell-review-HC.pdf

[131] V.M. Tangde, "Advances in hadronic chemistry and its applications," Foundation of Chemistry, DOI 10.1007/s10698-015-9218-z (March 24, 2015),
http://www.santilli-foundation.org/docs/hadronic-chemistry-FC.pdf

[132] M.O. Cloonan, "A new electronic theory of pericyclic chemistry and aromaticity is proposed: The Cplex-isoelectronic theory. Consistent with Santillis hadronic chemistry," Int. Journal Hydrogen Energy, 32, 159 (2007),
http://www.santilli-foundation.org/docs/Cloonan-Paper1.pdf

[133] Y. Yang, J.V. Kadeisvili, and S. Marton, "Experimental Confirmations of the New Chemical Species of Santilli Magnecules," The Open Physical Chemistry Journal Vol. 5, 1-16 (2013),
http://www.santilli-foundation.org/docs/Magnecules-2012.pdf

[134] A.K. Aringazin, "Toroidal configuration of the orbit of the electron of the hydrogen atom under strong external magnetic fields," Hadronic J. 24, 134 (2001),
http://www.i-b-r.org/docs/landau.pdf

[135] C.P. Pandhurnekar, "Advances on Alternative Fuels with Santilli Magnecular Structure," International Journal of Alternative Fuels, ISSN: 2051-5987, Vol.17, 2015
http://www.santilli-foundation.org/docs/Magnegas-2015.pdf

[136] S.P. Zodape, "Novel Chemical Species of Santilli's Magnegas," AIP Conference Proceedings 1648, 510022 (2015); doi: 10.1063/1.4912727,
http://www.santilli-foundation.org/docs/1.4912727(SP-Zodape).pdf

[137] S.S. Wazalwar, V. M. Tangde and A. A. Bhalekar, "Study of Combustion of Coal with Magnegas as Additive for Improved Combustion Efficiency: A Review of Present Scenario and Future Scope," AIP Conference Proceedings 1648, 510021 (2015); doi: 10.1063/1.4912726,
http://www.santilli-foundation.org/docs/1.4912726(Wazalwar-Tangde-Bhalekar).pdf

[138] Sangesh P. Zodape, "Novel Chemical Species of Santilli's Magnegas in Hadronic Chemistry," AIP Conference Proceedings 1648, 510022 (2015); doi: 10.1063/1.4912727,
http://www.santilli-foundation.org/docs/1.4912727(SP-Zodape).pdf

[139] V.M. Tangde and S. S. Wazalwar, "Magnegas - An Alternative Technology for Clean Third Special Issue: Foundations of Hadronic Chemistry dedicated to the 80th birthday of Prof. R. M. Santilli, American Journal of Modern Physics, in press (2016),
http://www.santilli-foundation.org/docs/FinalEdition-122015004-20150826.pdf

[140] C.P. Pandhurneka and Sangesh P. Zodape, "Santillis Magnecules and Their Applications," Third Special Issue: Foundations of Hadronic Chemistry dedicated to the

80th birthday of Prof. R. M. Santilli, American Journal of Modern Physics, in press (2016),
http://www.santilli-foundation.org/docs/FinalEdition_122015002_20150818.pdf

[141] S.S. Wazalwar and V. M. Tangde, "Magnecular Cleaning Coal Combustion Via MagneGas Additive," Third Special Issue: Foundations of Hadronic Chemistry dedicated to the 80th birthday of Prof. R. M. Santilli, American Journal of Modern Physics, in press (2016),
http://www.santilli-foundation.org/docs/FinalEdition-122015002-20150818.pdf

[142] V.M. Tandge, "An introduction to hadronic chemistry," lecture delivered at the 2002 international Workshop on Hadronic Chemistry, Kos, Greece,
http://www.world-lecture-series.org/san-marino-2012-an-introduction-to-hadronic-chemistry

[143] R.M. Santilli, An Introduction to Hadronic Chemistry, Invited Lecture delivered at the Institute for UltraFast Spectroscopy and Laser City College of New York on October 19, 2012,
http://www.world-lecture-series.org/lecture-iv-a

[144] R.M. Santilli, An Introduction to Hadronic Chemistry, Keynote speech at the International Workshop on Hadronic Chemistry, Mathematics and Physics October 21 to 26, 2013, India Department of Chemistry Rashtrasant Tukadoji Maharaj Nagpur University
http://www.world-lecture-series.org/santilli-india-2013

[145] R.M. Santilli, invited plenary lecture at the SIPS 2016 Congress, Hainan Island. China, on the new fuels with magnecular structure and their industrial applications.
https://www.youtube.com/watch?v=eyS6HDO5xDcfeature=youtu.be

[146] R.M. Santilli, *The New Fuels with Magnecular Structure*, International Academic Press (2008),
http://www.i-b-r.org/docs/Fuels-Magnecular-Structure.pdf
Italian translation by Giovanna Bonfanti and Michele Sacerdoti, Editori Riuniti, Roma, *Nuovi Carburanti con Struttura Magnecolare*,
http://www.i-b-r.org/docs/nuopvi-carburanti-magnecolari.pdf

[147] R.M. Santilli, U.S patents Numbers US6183604 B1, US6540966 B1, US6663752 B2, US6972118 B2, US20080014130 A1, US8236150 B2, US20140299463 A1, US20120033775 A1, from the website U.S. Patent and Trademark Office.

[148] R.M. Santiklli, "Method and Apparatus for the industrial production of new hydrogen-rich fuels" United States Patent Number 9,700,870, B2, July 11, 2017,
http://www.santilli-foundation.org/docs/Magnecule-patent.pdf

[149] N. Kapustka, "EMV Evaluation of Oxyfuel Gas Cutting Gases,"
http://thunder-energies.com/docs/MG-metal-cutting.pdf

[150] R. R. Alfano, "CCNY Certification of Magnegas Flame Temperature," Summary,
http://thunder-energies.com/docs/MG-Flame-report.pdf

[151] R.R. Alfano, "CCNY Certification of Magnegas Flame Temperature," Report
http://thunder-energies.com/docs/MG-Flame-report.pdf

[152] R.F. Frisch, "Chemical analysis of magnegas exhaust,"
http://thunder-energies.com/docs/MG-AAL-comnustion-analyses.pdf

[153] R.M. Santilli, "The novel magnecular species of hydrogen and oxygen with increased specific weight and energy content," Intern. J. Hydrogen Energy 28, 177-196 (2003),
http://www.santilli-foundation.org/docs/Santilli-38.pdf

[154] D. Day, TCD analysis and density measurements of Santilli Magnehydrogen. Eprida Laboratory report dated 11/10/11,
http://www.santilli-foundation.org/docs/Eprida-MH-Certification-10-11.pdf

[155] S.P. Zodape, "The MagneHydrogen in Hadronic Chemistry," This work is being presented at ICNAAM 2013 being held at Rhodes, Greece during or. AIP Proceedings 1558, 648 (2013); doi: 10.1063/1.4825575,
http://www.santilli-foundation.org/docs/sangesh-Greece.pdf

[156] Y. Yang, J.V. Kadeisvili, and S. Marton, "Experimental Confirmations of the New Chemical Species of Santilli MagneHydrogen," International Journal Hydrogen Energy Vol. 38, page 5002 (2013),
http://www.santilli-foundation.org/docs/MagneHydrogen-2012.pdf

[157] R. M. Santilli, A Classical Isodual Theory Of Antimatter And Its Prediction Of Antigravity, International Journal of Modern Physics A, 14 (1999) 2205-2238,
http://www.santilli-foundation.org/docs/Santilli-09.pdf

[158] R.M. Santilli, "Representation of antiparticles via isodual numbers, spaces and geometries," Comm. Theor. Phys. 1994 **3**, 153-181
http://www.santilli-foundation.org/docs/Santilli-112.pdf

[159] R.M. Santilli, "A new cosmological conception of the universe based on the isominkowskian geometry and its isodual, Part I pages 539-612 and Part II pages Contributed paper in Analysis, Geometry and Groups, A Riemann Legacy Volume, Volume II, H.M. Srivastava, Editor, pp. 539-612 (1993)

[160] R.M. Santilli, "Antigravity," Hadronic J. 1994 **17**, 257-284,
http://www.santilli-foundation.org/docs/Santilli-113.pdf

[161] P. Mills, "Possibilities of measuring the gravitational mass of electrons and positrons in free horizontal flight," contributed paper for the proceedings of the International Conference on Antimatter, held in Sepino, Italy, May 1996, published in the Hadronic J. 1996 **19,** 77-96,
http://www.santilli-foundation.org/docs/Santilli-11.pdf

[162] V. de Haan, "Proposal for the realization of Santilli comparative test on the gravity of electrons and positrons via a horizontal supercooled vacuum tube, Proceedings of the Third International Conference on the Lie-Admissible Treatment of Irreversible Processes, C. Corda, Editor, Kathmandu University, 2011, pages 57-67,
http://www.santilli-foundation.org/docs/deHaan-Arxiv.pdf

[163] V. de Haan, "Proposal for the realization of Santilli comparative test on the gravity of electrons and positrons via a horizontal supercooled vacuum tube, Proceedings of the Third International Conference on the Lie-Admissible Treatment of Irreversible Processes, C. Corda, Editor, Kathmandu University, (2011), pp. 57-67.
http://www.santilli-foundation.org/docs/Santilli-gravity-experiment.pdf

[164] A.E. Charman et al, ALPHA Collaboration, Description and first application of a new technique to measure the gravitational mass of antihydrogen," Nature Communications, April 2013. DOI: 10.1038/ncomms2787 [35] J. Dunning-Davies, Thermodynamics of Antimatter via Santillis isodualities, Foundations of Physics Letters, 12, (1999) pp. 593-599.

[165] R.M. Santilli, "Isotopic relativity for matter and its isodual for antimatter, Gravitation 1997, **3**, 2.

[166] P.S. Muktibodh, "Introduction to Isodual Mathematics and its Applica-tion to Special Relativity," American Institute of Physics Proceedings 2013,
http://www.santilli-foundation.org/docs/P-Muktibodh.pdf

[167] J. Dunning-Davies, Thermodynamics of antimatter via Santilli's isodualities. Found. Phys. Vol. 12, page 593 (1999),
http://www.santilli-foundation.org/docs/Isodual-therm.pdf

[168] S. Beghella-Bartoli, R. M. Santilli, "Possible Role of Antimatter Galaxies for the Stability of the Universe," American Journal of Modern Physics 2016; 5(2-1): 185-190,
http://www.santilli-foundation.org/docs/pdf11.pdf

[169] S. Beghella Bartoli, "Trajectories of antimatter bodies in our solar system according to the isodual theory of antimatter," Hadronic Journal Vol. 37, pages 1-27, 2014,
http://www.santilli-foundation.org/docs/Simone-FINAL.pdf

[170] R. M. Santilli, "Does antimatter emit a new light?" Invited paper for the proceedings of the International Conference on Antimatter, held in Sepino, Italy, on May 1996, published in Hyperfine Interactions 1997, **109**, 63-81
http://www.santilli-foundation.org/docs/Santilli-28.pdf

[171] R. M. Santilli, "Can antimatter asteroids, stars and galaxies be detected with current means?" in *Proceedings of the Third International Conference on the Lie-Admissible Treatment of Irreversible Processes*, C. Corda, Editor, Kathmandu University (2011) pages 25-36,
http://www.santilli-foundation.org/docs/Antimatter-Asteroid.pdf

[172] R. M. Santilli, "The Mystery of Detecting Antimatter Asteroids, Stars and Galaxies," American Institute of Physics, Proceed. 2012, **1479**, 1028-1032 (2012),
http://www.santilli-foundation.org/docs/antimatter-asteroids.pdf

[173] R. M. Santilli, "Apparent detection of antimatter galaxies via a telescope with convex lenses," Clifford Analysis, Clifford Algebras and their Applications vol. 3, 2014, pages 1-26 (Cambridge, U.K.),
http://www.santilli-foundation.org/docs/Antimatter-telescope-2013-final.pdf

[174] R. M. Santilli, "Representative pictures from the Antimatter telescope,"
http://www.santilli-foundation.org/docs/Antimatter-Vega-system-2013/Antimat-teles-view-1-composed.tif

[175] P. Bhujbal, J. V. Kadeisvili, A. Nas, S Randall, and T. R. Shelke. "Preliminary confirmation of antimatter detection via Santilli telescope with concave lenses," Clifford Analysis, Clifford Algebras and their Applications Vol. 3, pages 27-39, 2014 (Cambridge, UK),
http://www.santilli-foundation.org/docs/Con-Ant-Tel-2013.pdf

[176] S. Beghella-Bartoli, P. M. Bhujbal, A. Nas, "Confirmation of Santilli's Detection of Antimatter Galaxies via a Telescope with Concave Lenses," American Journal of Modern Physics, Vol. 4, pp 34-41 (2015),
http://www.santilli-foundation.org/docs/antimatter-detect-2014.pdf

[177] R. M. Santilli, "Apparent Detection of a New Antimatter Galaxy in the Capella Region of the Night Sky," Clifford Analysis, Clifford Algebras and their Applications, in press (2016),
http://www.santilli-foundation.org/docs/capella-antimatter-galaxy.pdf

[178] P.M. Bhujbal, "Santillis Detection of Antimatter Galaxies: An Introduction and Experimental Confirmation, AIP Conference Proceedings Vol. 1648 (2015) pp. 510005-1-510005-5.
http://www.santilli-foundation.org/docs/1.4912710(PM Bhujbal).pdf

[179] P.M. Bhujbal, Santillis Apparent Detection of Antimatter Galaxies: An Introduction and Experimental Confirmation, Hadronic Journal [Submitted for Publication] ISSN: 0162-5519,
http://www.santilli-foundation.org/docs/bhujpal- antim-2014.pdf

[180] A.A. Bhalekar,"Studies of Santilli's isotopic, genotopic and isodual four directions of time," American Institute of Physics proceedings, 2013,
http://www.santilli-foundation.org/news.html.

[181] R. Anderson, A. A. Bhalekar, B. Davvaz, P. Muktibodh, R. M. Tangde, and T. Vougiouklis, "An introduction to Santilli isodual theory of antimatter and the ensuing problem of detecting antimatter asteroids," Numta Bulletin 2012-2013, **6**, 1-33, http://www.santilli-foundation.org/docs/Antimatter-2013.pdf

[182] P.M. Bhujbal, "Santilli's isodual mathematics and physics for antimatter," American Journal of Modern Physics Vol. 5, No. 20-1, pp. 1610194 (2016), http://www.santilli-foundation.org/docs/bhujbal-2016.docx

[183] R. Anderson, A. A. Bhalekar, B. Davvaz, P. Muktibodh, V. M. Tangde, and T. Vougiouklis, "An introduction to Santilli's isodual theory of antimatter and the ensuing problem of detecting antimatter asteroids," Numta Bulletin Issue 67, pages 1-33, 2013, http://www.santilli-foundation.org/docs/Antimatter-2013.pdf

[184] Vougiouklis, An Introduction to Santilli's Isodual Representation of Antimatter and the Ensuing Problem of Detecting Antimatter Asteroids, Numta Bulletin Issue 6-7, (2013). pp. 1-33. http://www.santilli-foundation.org/docs/Antimatter-2013.pdf

[185] B. Davvaz, B. M. Santilli, and T. Vougiouklis, "Studies of Multi-Valued Hyperstructures for the Characterization of Matter-Antimatter Systems and their Extension, in Proceedings of the 2011 International Conference on Lie-admissible Formulations for Irreversible Processes, C. Corda, editor, Kathmandu University, Nepal, 2011, pages 45-57, http://www.santilli-foundation.org/Hyperstructures.pdf

[186] R.M. Santilli, "Apparent Detection via New Telescopes with Concave Lenses of Otherwise Invisible Terrestrial Entities," American Journal of Modern Physics Vol. 5, issue 3, pages 45-53, 2016, http://www.thunder-energies.com/docs/ITE-paper-12-15-15.pdf

[187] Thunder Energies Corporation, website http://www.thunder-energies.com/index.php/ct-menu-item-18/11-articles/17-article-8

[188] Thunder Energies Corporation, archives http://www.thunder-energies.com/index.php/ct-menu-item-13

[189] Thunder Energies Corporation, research Grant Application to DARPA, February 2017, http://www.thunder-energies.com/docs/grant-application-to-dtra.pdf http://www.thunder-energies.com/docs/DTRA-grant-application-ilovepdf.pdf http://www.thunder-energies.com/docs/the-neutron-gun.pdf