Santilli's Apparent Detection of Antimatter Galaxies: An Introduction and Experimental Confirmation

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Abstract.
Studies accompanied over the past few decades on the generalization of quantum mechanics known as hadronic mechanics, initiated in 1978 by the Italian-American physicist Ruggero Maria Santilli and its application for detection of light from antimatter galaxy is reported in this paper. The isodual (antimatter) light has negative energy $E^d = -E$ with negative unit, experiences a negative curvature tensor $R^d = -R$ (gravitational repulsion) when in a matter gravitational field, and possesses a negative index of refraction $n^d = -n$ when propagating within a transparent matter medium. Detection of antimatter galaxies is possible by the refractive telescope with concave lenses constructed by Santilli which follow the concept of negative energy and negative index of refraction for antimatter.

Keywords: antimatter, isodual light, antigravity
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1. INTRODUCTION and HISTORICAL NOTES

Newtonian, Galilean and Einsteinian theories had no value for the indicated problem since far away galaxies must be assumed to be neutral, in which case said theories had no distinction whatsoever between matter and antimatter. Santilli discovered that a mathematics for the consistent classical treatment of neutral (or charged) antimatter did not exist and had to be built. The resulting mathematics is today known as Santilli isodual mathematics. It may be of some value to indicate that isoduality is a new transformation not reducible to parity and/or other conventional transformations. We should also recall the new symmetry identified by the isodual mathematics, called isoselfduality [1-3], namely, the invariance under the isodual transformation, which is verified by the imaginary number $i \equiv i^d$ as well as by Dirac's equation.

Application of the Isodual mathematics helps to study antimatter galaxy light, since Isodual mathematics is anti-isomorphic to the conventional mathematics used for matter, and used it to the construction of the corresponding Isodual theory of antimatter which is applicable from the classical to the quantum level; and predicts that antimatter light propagating in a matter transparent medium possesses an index of refraction opposite that of matter light, which is referred to as a negative index of refraction [4]. Newton's mechanics, Galileo's relativity, Einstein's special and general relativities were conceived before the discovery of antimatter and, consequently, they have no provisions for the classical representation of neutral antimatter since their only conjugation is the sign of the charge. The rigorous prediction of antimatter via the negative energy solutions of wave equations was done by P. A. M. Dirac [5] in 1928, and experimentally verified in 1933 by C. D. Anderson [6]. However, Dirac noted that particles with negative energy violate causality and other physical laws and was consequently forced to represent antiparticles solely at the level of second quantization in his celebrated equation. Since the time of Dirac's prediction of antiparticles and their detection by Anderson [7], the theory of antimatter has been essentially developed at the level of second quantization. This occurrence has created an unbalance between the theories of matter and antimatter at the classical and first quantization levels, as well as a number of shortcomings, such as the inability for the classical theory of antimatter to have a quantized formulation which is the correct charge (or **PTC**) conjugate of that of matter. In an attempt to initiate the scientific process toward the future resolution of the above problematic aspects, Santilli proposed in 1985 [8] a new anti-isomorphic image of conventional mathematics charactered by the map of the conventional unit; $+1 \rightarrow 1^d = -1$; called for certain technical reasons isodual map, or isoduality.

It should be noted that the change of the basic unit implies a simple, yet unique and nontrivial change of the totality of conventional mathematics, including: numbers and angles; functions and transforms; vector and metric spaces; algebras and geometries; etc. In 1991 Santilli [9] showed that the above isodual mathematics, since it is an anti-isomorphic image of the mathematics of matter, provides a novel classical representation of antimatter. The proof that isoduality on a Hilbert space is equivalent to charge conjugation has first appeared in paper [10] of 1994. A comprehensive operator treatment subsequently appeared in monographs [11]. The prediction that isoduality implies antigravity for massive antiparticles in the field of matter was submitted in paper [12], which also included the proposal for its experimental verification via the use of a low energy positron beam in horizontal flight in a suitable vacuum tube. The latter experimental proposal was subsequently studied by Mills [13]. This note is devoted to a study of the spectroscopy of antimatter via the isodual characterization of the light emitted by the antihydrogen atom. In particular, Santilli has shown that isoduality predicts that antimatter emits a new light here called isodual light which can be solely differentiated from the conventional light via gravitational interactions. In the events additional theoretical and experimental studies confirm the above hypothesis; isoduality would therefore permit the future experimental measures whether far away galaxies and quasars are made up of matter or of antimatter [14].

In particular, it should be kept in mind that, as repeatedly stated by Professor Santilli, the isoduality is the only known consistent procedure for the differentiation between neutral as well as charged matter and antimatter at all levels of treatment. A main difference in the treatment of antimatter between 20th century Einsteinian theories and the novel isodual theories is the following. Special relativity and relativistic quantum mechanics characterize antimatter with the same positive energy used for matter. By contrast, the isodual theory characterizes antimatter via a negative energy referred to as a negative unit, thus being as causal as a positive energy referred to as a positive unit. Similarly, according to the isodual theory, antiparticle evolve in a negative time referred to a negative unit of time, thus yielding an evolution as causal as that of particles evolving in a positive time referred to positive units. It should be stressed that the joint isodual conjugation of a physical quantity and its related unit is mandatory for consistency of the theory, as well as for the very achievement of scientific democracy for the treatment of matter and antimatter. Similarly, Einsteinian theories predict that matter and antimatter emit the same light, evidently due to the indicated lack of any differentiation between neutral matter and antimatter, light having no charge as is well known. By contrast, isodual theories predict that the light emitted by antimatter is different than that emitted by matter in an experimentally verifiable way. In fact, matter light has a positive energy h x ν referred to positive unit MeV, while antimatter light has a negative energy $E^d = h^d\ x^d\ \nu^d = -E$ referred to a negative unit $MeV^{\ d} = -MeV$ [15].

The isodual theory has a number of rather fundamental, experimentally verifiable predictions not tested until now. A first new prediction is that antimatter (matter) in the gravitational field of matter (antimatter) experiences a gravitational repulsion (antigravity). Again, this prediction can be solely formulated under isodual rules, that is, the systematic, step-by-step construction of the isodual Riemannian geometry and related gravitational formulation of antimatter bodies. A negative curvature tensor (representing gravitational repulsion) then occurs in the interplay between a Riemannian gravitation and its isodual [4].

Similarly, Einsteinian theories predict that both, matter and antimatter light experience gravitational bending (attraction). By contrast, the isodual theory predicts that antimatter (matter) light experiences gravitational repulsion from a matter (antimatter) gravitational field. Note that the differentiation between matter and antimatter light is mandatory under isoduality which, in turn, is the only known differentiation between neutral matter and antimatter, thus including matter and antimatter light [15].

In short in the preceding works, Santilli has: 1) developed an anti-Hermitean image of the mathematics used for matter characterized by a map called isoduality and denoted with the upper symbol d; 2) achieved the isodual classical representation of neutral (as well as charged) antimatter particles and light via the conjugation of all physical quantities and their units, thus resolving the inconsistencies of negative energies; and 3) shown that the isodual (antimatter) light has negative energy $E^d = -E$, experiences a negative curvature tensor $R^d = -R$ (gravitational repulsion) when in a matter gravitational field, and possesses a negative index of refraction $n^d = -n$ when propagating within a transparent matter medium.

An attempt is made to present a short review of the apparent detections of antimatter galaxies and its experimental confirmation by Santilli and co-workers [16-18] in this paper.

2. Santilli's Isodual physics

2.1. QFT (And QCD) Violations from Discrete Symmetry Violations (1974)

The rigorous implementation of Lie's theory demands that the fundamental symmetry of special relativity, the Poincare symmetry, is given by a continuous component characterized by the Lorentz symmetry, and discrete components characterized by space and time inversions.

In the early part of the 20th century, the entire Poincare symmetry was assumed to be exactly valid throughout the universe. The discovery of parity violation by weak interactions, rather than causing scientific joy, caused panic among the Einsteinian followers because of fear that the entire edifice may collapse. Organized interests on a world wide basis were then activated in the physics community to reach a vast consensus, intentionally without any technical inspection, that "the violation of discrete symmetries does not cause the violation of the continuous component of the Poincare symmetry or of special relativity," a popular political belief without scientific process that is still widespread at mid 2008.

Santilli conducted in the 1970s quantitative technical studies as to whether the violation of discrete symmetries implies that of the connected Lorentz symmetry and, consequently, of special relativity. The analysis was conducted with the most advanced and rigorous technical knowledge in quantum field theory of the time, that via Wightman's axioms.

Being an applied mathematician, Santilli was fascinated by the beauty of quantum field theory (QFT) characterized by Whitman axioms. However, being a physicist, he also knew that such a theory had to admit limits of exact applicability because physics will never admit final theories to the end of time. Thus, he initiated comprehensive studies for the identification of such limits of applicability as a necessary foundation for suitable covering theories.

The *discrete symmetries* of quantum field theories are given by the following operations and their combinations:

$$\text{P (space inversion), C (charge conjugation), T (time inversion),}\quad \text{PC, CT, PT, PCT.} \tag{1}$$

The *PCT theorem* within the context of vacuum expectation values (VEV) verifying Wightman's axioms essentially related the PCT conditions to the weak local commutativity conditions (WLC) under the assumption of Lorentz invariance for the vacuum expectation values plus, boundedness of the energy from below and other conditions permitting smooth analytic continuations.

Santilli achieved the *extension of the PCT theorem to all discrete spacetime symmetries,* a possibility simply unknown at that time. To achieve this goal, he derived the following *dual discrete symmetries*:

$$P^{\#} = (PC)(WLC),\ C^{\#} = WLC,\ T^{\#} = (TC)(WLC),\ PC^{\#} = P(WLC),$$
$$CT^{\#} = T(WLC),\ PT^{\#} = (PCT)(WLC),\ PCT^{\#} = PT(WLC), \tag{2}$$

and proved the following:

THEOREM*: Under Lorentz invariance, analyticity and energy boundedness from below, the validity (at a Jost point) of any discrete symmetry in a quantum field theory satisfying the Whitman axioms implies that of its dual and vice versa:*

$$P \leftrightarrow T^{\#},\ C \leftrightarrow PCT^{\#},\ T \leftrightarrow P^{\#},\ PC \leftrightarrow CT^{\#},$$
$$CT \leftrightarrow PC^{\#},\ PT \leftrightarrow C(WLC),\ PCT \leftrightarrow C^{\#}, \tag{3}$$

The implications of the above discovery presented in the papers quoted below are the following: For quantum field theories admitting discrete symmetries, Santilli's **Theorem** implies the validity of *basically new* discrete symmetry that can be experimentally verified. For theories violating any discrete symmetry, **Theorem** implies that, whenever a discrete symmetry is violated, the corresponding dual symmetry has to be violated too, and vice versa [19-21].

2.2. Apparent lack of visibility of antimatter asteroids with Sun light

Santilli has achieved a representation of antimatter at all possible levels, from Newtonian mechanics to second quantization and for conditions of increasing complexity, from fully conservative conditions to the most general possible irreversible non-Hamiltonian conditions, as well as hyperstructural conditions expected in possible antimatter living structures. These studies are far from trivial and have direct implications for the very safety of our planet, since they predict that antimatter asteroids are not visible with the light of our matter Sun. In fact, the studies predict that light emitted by a matter star annihilates when hitting an antimatter body without any refraction. Alternatively, the studies predict that light emitted by an antimatter star, called by Santilli isodual light, annihilates when hitting matter, thus not reaching us on Earth due to annihilation in the upper atmosphere, as it is the case for antimatter cosmic rays.

In short, Santilli has initiated an entire new field called antimatter astrophysics whose primary aim is the identification of methods for the detection of antimatter stars, by nothing that their isodual light is expected to annihilate even in lenses of telescopes orbiting in space, thus requiring a basically new conception of antimatter telescopes.

It should be noted that, Einstein special and general relativity have no means for differentiating between neutral matter and antimatter as expected for asteroids and stars. As a consequence, antimatter has been assumed as being nonexistent in the universe in any appreciable amount. Santilli's discoveries indicates that antimatter has not been detected because of the above indicated occurrences, namely, the annihilation of our Sun light in an antimatter asteroid, or the annihilation of light from an antimatter star in our atmosphere or in orbiting telescopes [21].

2.3. Newton-Santilli isodual equation for antimatter

No consistent classical theory of antimatter existed prior to Santilli's research, to our best knowledge as yet. For instance, by resuming the use of the conventional associative multiplication a x b = ab, the celebrated Newton's equation,

$$m \times dv/dt = F(t, r, v, \ldots..) \qquad \textbf{(4)}$$

or the celebrated Newton's gravitation

$$F = g \times m_1 \times m_2/r^2 \qquad \textbf{(5)}$$

solely apply for matter, and have no means whatsoever to distinguish between matter and antimatter for the very simple reason that antimatter was inconceivable at Newton's times.

Prior discovery of his isodual mathematics, Santilli developed the isodual theory of antimatter that holds at all levels of study, thus restoring full democracy between matter and antimatter.

In essence, in the 20th century antimatter was empirically treated by merely changing the sign of the charge, under the tacit assumption that antimatter exists in the same space as that for matter. Thus, both matter and antimatter were studied with respect to the same numbers, fields, spaces, etc. However, a correct classical representation of antimatter required a mathematics that is antiisomorphic to that used for matter as a necessary condition to admit a charge conjugated operator image.

Santilli represents antimatter via his anti-Hermitean isodual map that must be applied to the totality of quantities used for matter and all their operations. Hence, under isoduality, we have not only the change of the sign of the charge, but also the isodual conjugation of all remaining physical quantities (such as coordinates, momenta, energy, spin, etc.) and all their operations. This is the crucial feature that allows Santilli to achieve a consistent representation of antimatter also for neutral bodies.

We have in this way the Newton-Santilli isodual equation for antiparticles that we write in the simplified form

$$m^d x^d d^d v^d /^d d^d t^d = F^d(t^d, r^d, v^d, \ldots..) \qquad \textbf{(6)}$$

where “d" denotes isodual map, and the same conjugation holds for gravitation, too.(see below).

Note that, after working out all isodual maps, antiparticle equation **(6)** merely yields minus the value of the conventional equation for particles in both the l.h.s. and the r.h.s, thus appearing to be trivial. However, a most important feature of the above equation is that it defines antiparticles in a new space, the Euclid-Santilli isodual space, which is coexistent but different than our own space. The Euclidean space and its isodual then form a two-valued hyperspace.

In this section we shall show that, starting from the fundamental equation **(6)**, the isodual theory of antimatter is consistent at all subsequent levels, including quantization, at which level it is equivalent to charge conjugation.

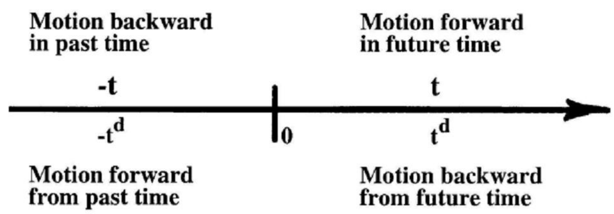


Figure 1: Contrary to popular beliefs, time has four directions as depicted by Santilli in this figure to illustrate the need for isoduality. In fact, time reversal can only allow the representation of two time directions. The remaining two time directions can solely be represented via the isodual map [21, 22].

Note that isodual antiparticles have a negative energy. This feature is dismissed by superficial inspections as being nonphysical, thus venturing judgments prior to the acquisition of technical knowledge. In fact, negative energies are indeed nonphysical, but when referred to our space time, that is, with respect to positive units of time. By contrast, when referred to negative units, all known objections on negative energies become inapplicable, let alone resolved.

Note also that isodual antiparticles move backward in time. This view was originally suggested by Stueckelberger in the early 1900s, and then adopted by various physicists, such as Feynman, but dismissed because of causality problems when treated with our own positive unit of time. Santilli has shown that motion backward in time referred to a negative unit of time $t^d = - t$ is as causal as motion forward in time referred to a positive unit of time t, and this illustrates the nontriviality of the isodual map.

Moreover, the assumption that particles and antiparticles have opposing directions of time is the only one known giving hopes for the understanding of the process of annihilation of particles and their antiparticles, a mechanisms utterly incomprehensible for the 20th century physics [21].

2.4. Isodual Representation of the Coulomb Force

The isodual theory of antimatter verifies all classical experimental evidence on antimatter because it recovers the Coulomb law in a quite elementary way. Consider the case of two particles with the same negative charge and Coulomb Law

$$F = (-q_1) \times (-q_2)/(r \times r) \qquad \textbf{(7)}$$

where the positive value of the r.h.s is assumed as representing repulsion, and the constant is assumed to have the value 1 for simplicity.

Under isoduality, the above expression becomes

$$F^d = (-q_1)^d \times^d (-q_2)^d /^d (r^d \times^d r^d) \qquad \textbf{(8)}$$

thus reversing the sign of the equation for matter, $F^d = - F$. However, antimatter is referred to a negative unit of the force, charge, coordinates, etc. Hence, a positive value of the Coulomb force referred to a positive unit representing repulsion is equivalent to a negative value of the Coulomb force referred to a negative unit, and the latter also represents repulsion.

For the case of the electrostatic force between one particle and an antiparticle, the Coulomb law must be projected either in the space of matter

$$F = (-q_1) \times (-q_2)^d/(r \times r) \qquad \textbf{(9)}$$

representing attraction, or in that of antimatter

$$F = (-q_1)^d \times^d (-q_2) /^d (r^d \times^d r^d) \qquad \textbf{(10)}$$

in which case, again, we have attraction, thus representing classical experimental data on antimatter [21].

2.5. Hamilton-Santilli isodual mechanics

To proceed in his reconstruction of full democracy in the treatment of matter and antimatter, Santilli had to construct the isodual image of Hamiltonian mechanics because essential for all subsequent steps. In this way he reached what is today called the Hamilton-Santilli isodual mechanics based on the isodual equations

$$d^d r^d /^d d^d t^d = \partial^d H^d(r^d, p^d) /^d \partial^d p^d, \; d^d p^d /^d d^d t^d = -\partial^d H^d(r^d, p^d)/ \partial r \qquad \textbf{(11)}$$

and their derivation from the isodual action A^d (a feature crucial for quantization), from which the rest of the Hamilton-Santilli isodual mechanics follows [21].

2.6. Isodual special and general relativities

The special and general relativities are basically unable to provide a consistent classical treatment of antimatter. Santilli has resolved this insufficiency by providing a detailed, step by step isodual lifting of both relativities with a mathematically consistent representation of antimatter in agreement with classical experimental data. The reader should be aware that the above liftings required the prior isodual images of the Minkowskian geometry, the Poincare symmetry and the Riemannian geometry, as well as the confirmation of the results with experimental evidence [21].

2.7. Prediction of antigravity

Studies on antigravity were dismissed and disqualified in the 20th century on grounds that "antigravity is not admitted by Einstein's general relativity." This posture resulted in a serious obscurantism because general relativity cannot represent antimatter, thus being disqualified for any serious statement pertaining to the gravity between matter and antimatter.

Thanks to his isodual images of special and general relativity, Santilli has restored a serious scientific process in the field, by admitting quantitative studies for all possibilities, and has shown that once antimatter is properly represented, matter and antimatter must experience antigravity (defined as gravitational repulsion) because of supporting compatible arguments at all levels of study, with no known exclusion. In fact, all known "objections" against gravitational repulsion between matter and antimatter become inapplicable under Santilli isoduality, let alone meaningless.

The arguments in favor of the above conclusion are truly forceful because differentiated and mutually compatible. As a trivial illustration, we have the repulsive Newton-Santilli force between a particle and an isodual particle (antiparticle) both treated in our space

$$F = g \times m_1 \times m^d_2/r^2 = -g \times m_1 \times m_2.r^2 \quad \textbf{(12)}$$

which is indeed repulsive. The same conclusion is reached at all levels of study.

It should be indicated that a very compelling aspect supporting antigravity between matter and antimatter is Santilli's identification of gravity and electromagnetism. In fact, the electromagnetic origin of exterior gravitation mandates that gravity and electromagnetism must have similar phenomenologies, thus including both attraction and repulsion [21].

2.8. Test of antigravity

Santilli has proposed an experiment for the final resolution as to whether antiparticles in the gravitational field of Earth experience attraction or repulsion. The experiment consists in the measure of the gravitational force of a beam of positrons in flight on a horizontal vacuum tube 10 m long at the end of which there is a scintillator. Then, the displacement due to gravity is visible to the naked eye under a sufficiently low energy (in the range of the 10^{-3} eV). The experiment was studied by the experimentalist Mills and shown to be feasible with current technologies and resolutory [21].

2.9. Isodual quantum mechanics

Next, Santilli constructed a step-by-step image of quantum mechanics under his isodual map based on the Heisenberg-Santilli isodual time evolution for an observable Q

$$i^d \times^d d^dQ^d/^dd^dt^d = [Q, H]^d = H^d \times^d Q^d - Q^d \times^d H^d \quad \textbf{(13)}$$

and related isodual canonical commutation rules, Schrodinger-Santilli isodual equations, etc.

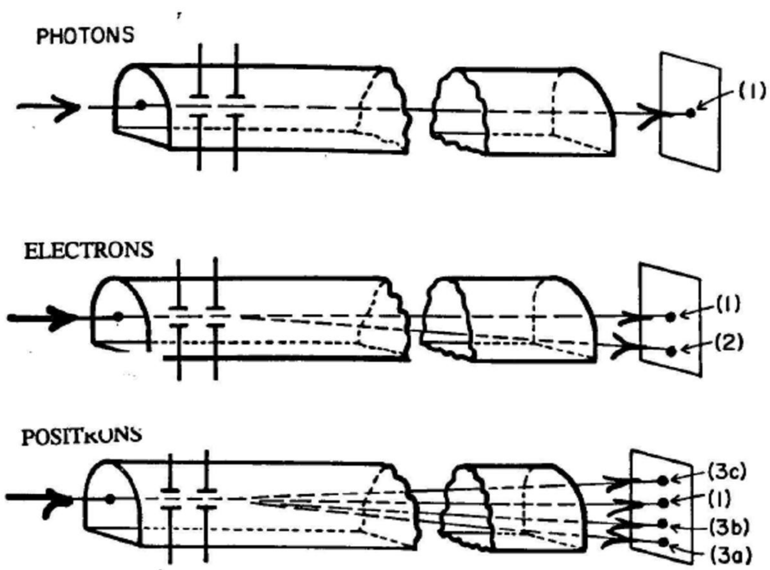


Figure 2: The original illustration used by Santilli for the 1994 proposal to test the gravity of positrons in horizontal light in a vacuum tube. The proposal has been qualified by experimentalists as being technically feasible nowadays and resolutory because the displacement due to gravity on a scintillator at the end of a 10 m light for positrons with milli-eV energy is visible to the naked eye. The usual criticisms based on disturbances caused by stray fields have been disqualified as political for a tube with at least 50 cm diameter. Virtually all major physics laboratories around the world have rejected even the consideration of the test, despite its dramatically lower cost and superior scientific relevance compared to preferred tests, on grounds that "Einstein theories do not admit

antigravity," although with documented knowledge that said theories cannot consistently represent antimatter as reviewed in the test [21].

He then proved that, at the operator level, isoduality is equivalent to charge conjugation. Consequently, the isodual theory of antimatter verifies all experimental data at the operator level too. Nevertheless, there are substantial differences in treatment, such as:
1) Quantum mechanics represents antiparticles in the same space of particles, while under isoduality particles and antiparticles exist in different yet coexisting spaces;
2) Quantum mechanics represents antiparticles with positive energy referred to a positive unit, while isodual antiparticles have negative energies referred to a negative unit;
3) Quantum mechanics represents antiparticles as moving forward in time with respect to our positive time unit, while isodual antiparticles move backward in time referred to a negative unit of time [21].

2.10. Experimental detection of antimatter galaxies

The isodual theory of antimatter was born out of Santilli's frustration as a physicist for not being able to ascertain whether a far away star, galaxy or quasar is made up of matter or of antimatter. Santilli has resolved this uneasiness via his isodual photon γ^d namely, photons emitted by antimatter that have a number of distinct, experimentally verifiable differences with respect to photons γ emitted by matter,

$$\gamma^d \neq \gamma \qquad \textbf{(14)}$$

thus allowing, in due time, experimental studies on the nature of far away astrophysical objects.

A most important difference between photons and their isoduals is that the latter have negative energy, as a result of which, isodual photons emitted by antimatter are predicted to be repelled in the gravitational field of matter. A possibility for the future ascertaining of the character of a far away star or quasar is, therefore, the test via neutron interferometry or other sensitive equipment, whether light from a far away galaxy is attracted or repelled by the gravitational field of Earth [21].

2.11. The new isoselfdual invariance of Dirac's equation

Santilli has released the following statement on the Dirac equation**:** I never accepted the interpretation of the celebrated Dirac equation as presented in the 20-th century literature, namely, as representing an electron, because the (four-dimensional) Dirac's gamma matrices are generally believed to characterize the spin 1/2 of the electron. But Lie's theory does not allow the SU(2)-spin symmetry to admit an irreducible 4-dimensional representation for spin 1/2, and equally prohibits a reducible representation close to the Dirac's gamma matrices. Consequently, Dirac equation cannot represent an electron intended as an elementary particle since elementarily requires the irreducible character of the representation. In the event Dirac's gamma matrices characterize a reducible representation of the SU(2)-spin, Dirac's equation must represent a composite system.

I discovered the isodual theory of antimatter by examining with care Dirac's equation. In this way, I noted that its gamma matrices contain a conventional two-dimensional unit I_{2X2} = Diag.(1, 1), as well as a conjugate negative-definite unit - I_{2X2}. That suggested me to construct a mathematics based on a negative definite unit. The isodual map come from the connection between the conventional Pauli matrices σ_k, k = 1, 2, 3, referred to I_{2x2} and those referred to $-I_{2x2}$. In this way I reached the following interpretation of Dirac's gamma matrices as being the tensorial product of I_{2x2}, σ_k times their isoduals,

$$\{I_{2x2}, \sigma_k, k = 1, 2, 3\} \ X \ \{I^d_{2x2}, \ \sigma_k^d, \ k = 1, 2, 3\} \qquad \mathbf{(15)}$$

Therefore, I reached the conclusion that the conventional Dirac equation represents the tensorial product of an electron and its isodual, the positron. In particular, there was no need to use the "hole theory" or second quantization to represent antiparticles since the above re-interpretation allows full democracy between particles and antiparticles, thus including the treatment of antiparticles at the classical level, let alone in first quantization.

By continuing to study Dirac's equation without any preconceived notion learned from books, I discovered yet another symmetry I called isoselfduality, occurring when a quantity coincides with its isodual, as it is the case for the imaginary unit $i^d = i$. In fact, Dirac's gamma matrices are isoselfdual,

$$\gamma_\mu{}^d = \ \gamma_\mu \, , \ \ \mu = 0, 1, 2, 3. \qquad \mathbf{(16)}$$

This new invariance can have vast implications, all the way to cosmology, because the universe itself could be isoselfdual as Dirac's equation, in the event composed of an equal amount of matter and antimatter. In conclusion, Dirac's equation is indeed one of the most important discoveries of the 20th century with such a depth that it could eventually represent features at the particle level that actually hold for the universe as a whole [21].

3. Santilli's Isodual Mathematics

Santilli has been interested since his graduate studies to ascertain whether a far away galaxy is made up of matter or of antimatter. He soon learned that Newtonian, Galilean and Einsteinian theories had no value for the indicated problem since far away galaxies must be assumed to be neutral, in which case said theories had no distinction whatsoever between matter and antimatter. For this reason, Santilli initiated a long journey that first required the identification of mathematical means for the consistent classical distinction between neutral matter and antimatter prior to any possible physical application. Santilli discovered that a mathematics for the consistent classical treatment of neutral (or charged) antimatter did not exist and had to be built.

Following the study of a number of alternatives, Santilli gave priority to the search for new numbers since all mathematics used for physics must be based on a numeric field as a condition for experimental verifications and, in any case, all aspects of applied mathematics can be built on a given numeric field via simple compatibility arguments. In 1993, Santilli [23, 24] finally identified the desired new number under the name of isodual real, complex and quaternionic numbers [25], which verify the condition of being anti-isomorphic to the conventional real, complex and quaternionic numbers, respectively. The word "isodual" was suggested to indicate a duality under the preservation of the conventional abstract axioms of numeric fields.

The crucial condition of anti-isomorphism was achieved via the anti-Hermitean conjugation of all elements of a numeric field and all its operations. This implies that, given a field $F(n,\times,1)$ with elements n, m, …, conventional associative product $n\times m = nm$ and trivial unit 1, Santilli isodual fields are indicated with the upper symbols d, $F^d(n^d,x^d,1^d)$, and are characterized by a negative basic unit $1^d = -1^\dagger = -1$, isodual numbers $n^d = n1^d$ and isodual product $n^d\times^d m^d = n^d(-1/-1^d)m^d = nm1^d$.

Following the identification of the desired numbers, Santilli passed to the systematic construction of the isodual image of all main mathematics used for the study of matter, including functional analysis, differential calculus, metric spaces, Lie algebras, symmetries, Euclidean, Minkowskian and Riemannian geometries, etc. These isodual formulations were first presented in the mathematical memoir [1] and first treated systematically in monographs [2]. The resulting mathematics is today known as Santilli isodual mathematics. It may be of some value to indicate that isoduality is a new transformation not reducible to parity and/or other conventional transformations. We should also recall the new symmetry identified by the isodual mathematics, called isoselfduality [1, 2], namely, the invariance under the isodual transformation, which is verified by the imaginary number $i \equiv i^d$ as well as by Dirac's equation.

Contrary to a possible perception of mathematical complexities, the isodual mathematics needed for applications can be constructed via the application of the simple anti-Hermitean map $Q \rightarrow Q^d = -Q^\dagger$, provided it is applied to the totality of quantities and to the totality of their operations used for the treatment of matter. Readers should be alerted that, in the absence of even one isodual map, there are inconsistencies that generally remain undetected to non-experts in the field.

4. Santilli's Isodual Theory of Antimatter

Santilli initiated systematic applications of isodual mathematics to the study of antimatter resulting in the new theory today called *isodual theory of antimatter (or Santilli's Isodual Physics)* as one of the branches of the broader *hadronic mechanics* [4, 21]. A main feature is that all quantities that are positive (negative) for the study of matter become negative (positive) for the study of antimatter, with the clarification that all positive and negative matter quantities are referred to positive units of measurements for matter, while all negative and positive antimatter quantities are referred to negative units. In particular, antimatter is predicted to have negative energy $E^d = -E$ exactly as conceived by Dirac [5] and evolve along a negative time $t^d = -t$ according to an old attempt to understand annihilation of matter and antimatter. Causality and other physical problems are resolved by the isodual mathematics, since negative quantities are measured in terms of negative units. Hence, antimatter evolving backward in time with respect to negative units of time is as causal as matter evolving forward in time with respect to positive units of time. The same holds for negative energy referred to negative units, and of other negative quantities.

The first known formulation of Newton equation for antiparticles is based on the Newton-Santilli isodual equations, and confirmed their verification of all known experimental data on the classical behavior of antiparticles [1].

A systematic presentation of the isodualities of Euclidean, Minkowskian and Riemannian geometries, Lie theory, rotational, Galilean, Lorentz and Poincare symmetries, Galilean and special relativities, and other basic formulations is provided which in particular, presented the first known consistent representation of the gravitational field of an antimatter body via the Riemann-Santilli isodual geometry [2].

New isoselfdual cosmology at the limit of equal amounts of matter and antimatter, in which case all total quantities of the universe, such as total time, total mass, total energy, etc., are identically null to avoid a discontinuity at creation and set up the basis for continuous creation [26].

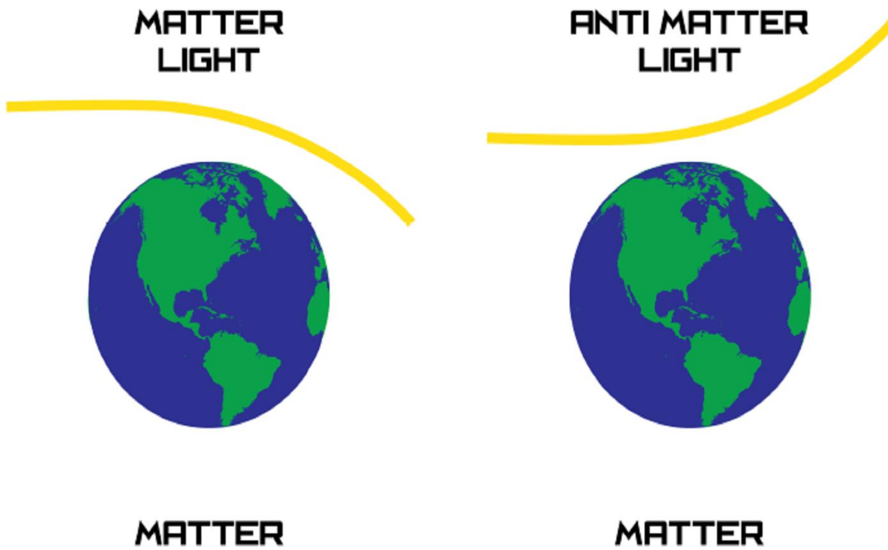


Figure 3: The prediction of Repulsion of antimatter light by a matter gravitational field

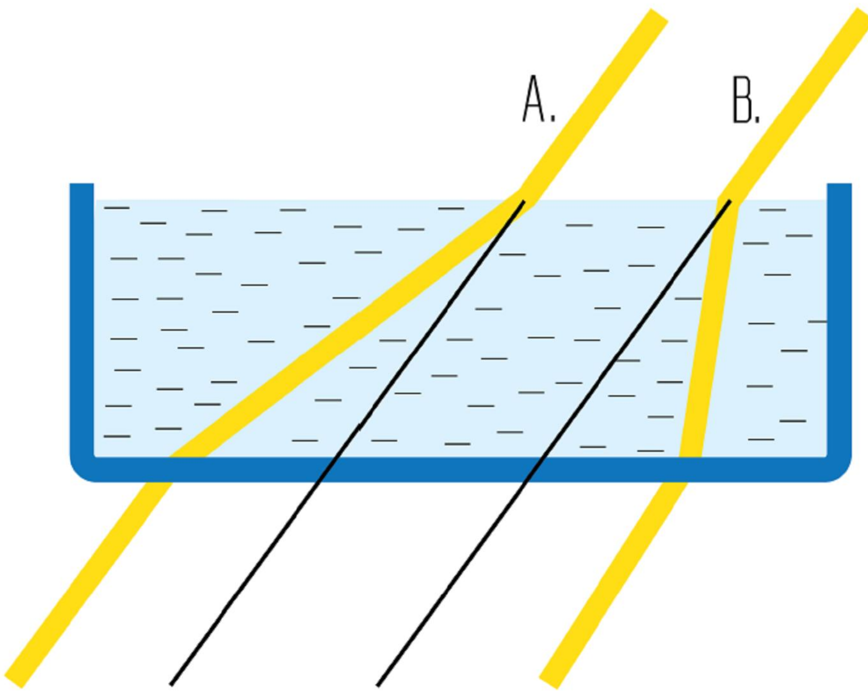


Figure 4: The prediction of negative index of refraction of antimatter light within matter water.

The light emitted by antimatter, also called isodual light, resulting in a prediction of main character for the detection of antimatter galaxies according to which antimatter light is physically different than matter light in an experimentally verifiable way. Since the photon has no charge, the only possible conjugation is that for all other physical quantities. As a result, antimatter light is predicted to possess negative energy while all other characteristics are opposite to those of matter light. In particular, antimatter light is predicted to be repelled by matter gravity (Fig. 3), thus permitting the conception of experiments, e.g. via neutron interferometry, to verify whether one of the two photons emitted in electron-positron annihilation experiences repulsion in our gravitational field [14].

The first known hypothesis presented that the antimatter light possesses a negative index of refraction $n^d = -n$ when propagating within a transparent matter medium. Again, the consistent characterization of neutral antimatter requires the conjugation of all quantities with no exclusion to avoid catastrophic inconsistencies. This implies the necessary conjugation of the index of refraction into a negative value referred to our positive units of measurements since it is observed in our matter world (Fig. 4) [17].

An important implication of the isodual theory of antimatter is the clarification that *the conventional Dirac equation characterizes the tensorial product of one point--like particle with spin ½ and its antiparticle without any need for second quantization* [4]. Santilli could not accept the conventional 20th century view that Dirac's equations represents only one particle with spin ½ because there exists no irreducible or reducible representation of the SU(2)-spin symmetry with the structure of Dirac's gamma matrices. Therefore, the author re-inspected Dirac's equation and showed that $\gamma^k = \sigma^k \times \sigma^{dk}$. And $\gamma^4 = \mathrm{Diag.}(I_{2x2}, - I_{2x2})$ thus yielding the indicated characterization of a spin ½ particle and its antiparticle.

Dirac himself provided the true foundation of the isodual theory of antimatter by characterizing antiparticles with the *negative unit* $-I_{2x2}$. Dirac merely missed the *mathematics* for the consistent physical treatment of negative energies. Note that there is no contradiction for a representation of antiparticle at the quantum mechanical level because the isodual theory of antiparticles applies at the classical level, let alone that of first quantization.

It should be aware that a negative index of refraction implies that antimatter light propagates within a transparent matter medium at superluminal speeds. A conceptual interpretation of this prediction is that the ordinary (positive) index of refraction for matter light propagating within a transparent matter medium is due to various, ultimately attractive interactions that slow down the speed of matter light. By contrast, when antimatter light propagates within a transparent matter medium, for consistency, all features of matter have to be conjugated, resulting in new repulsive interactions between antimatter light and the matter medium that, as such, accelerate antimatter light to superluminal speeds.

5. Santilli Telescope and Experimental Details

Santilli has been constructed a new refracting telescope with "concave" lenses; known as Santilli telescope; for detection of antimatter light from distant sources, because a conventional telescope with convex lenses will disperse light with a negative index of refraction. For that Santilli secured the design and fabrication of two identical Galileo refracting telescopes; without the star diagonal viewer to avoid any unnecessary reflection of antimatter light.

Figure 5: The two identical Galileo telescopes and the camera.

One of the two telescopes converted to a concave version with identical but conjugated foci. The transformation of the telescope from the Galileo form with 100 mm effective convex primary lenses, to the Santilli's antimatter telescope with features identical to those the Galileo one but conjugated based on Santilli's isodual mathematics as described above. Since the camera is directly attached to the telescope without the eyepiece, this conversion essentially consisted in the fabrication and assembly of concave lenses as per the data of Fig. 6 and Fig. 7 provides a comparative view of the Galileo and the Santilli's antimatter telescope.

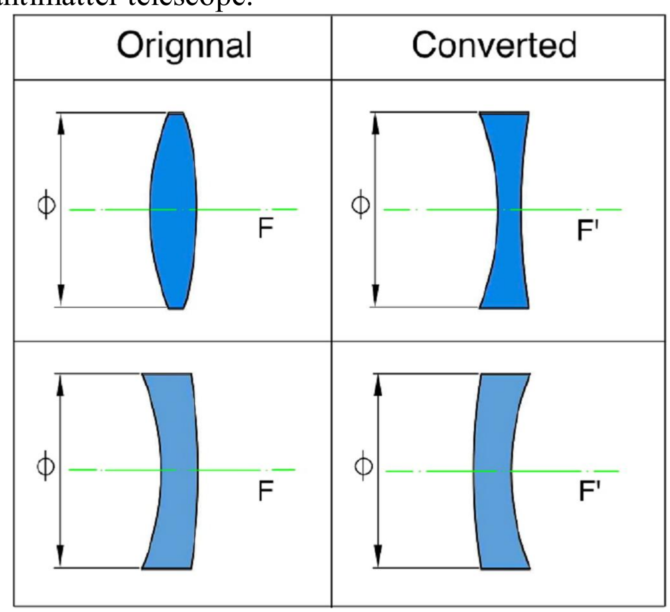


Figure 6: Main characteristics of the Galileo and antimatter primary lenses

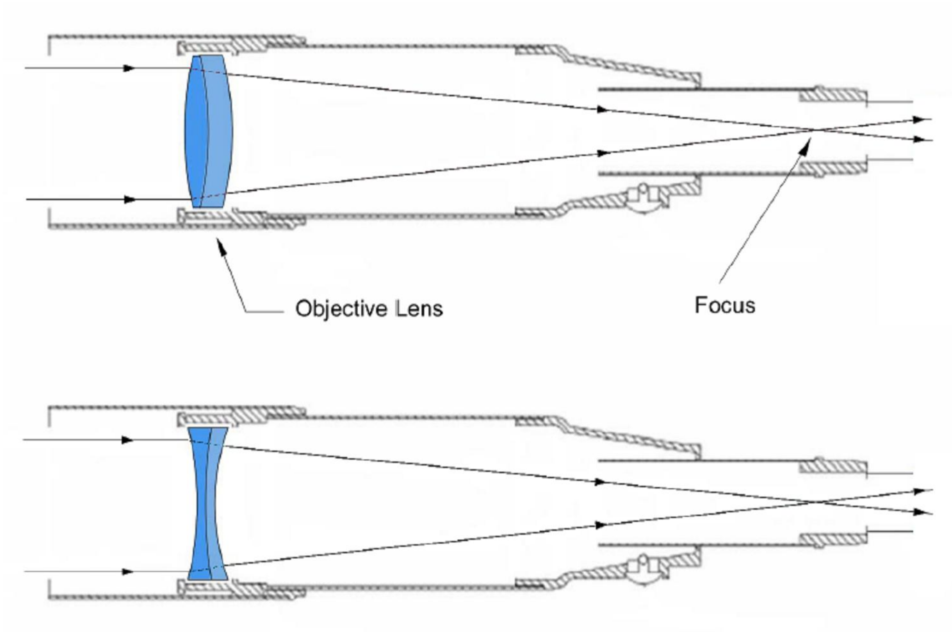


Figure 7: Schematic view of the telescopes with convex and concave lense

He secured one single suitably selected camera to obtain pictures from both the Galileo and the Santilli telescopes. He also secured a tripod with mount suitable for the parallel housing of the two telescopes. He optically aligned the two telescopes on the tripod by keeping in mind the evident impossibility of doing visual alignments with the antimatter telescope and conducted a number of day views with the so mounted and aligned pair of Galileo and Santilli telescopes to verify that astronomical objects visible in the former are not visible in the latter.

Figure 8: The parallel mount of the Galileo and antimatter telescopes with related finder scopes.

Figure 9: A close up view of the mounting of the camera directly in the telescope in place of the eyepieces.

A number of night views of the same region of the sky via the so mounted and aligned Galileo and Santilli telescopes was conducted and obtained a number of pictures from both telescopes via the selected camera; and finally conducted a comparative inspection of the pictures from both telescopes under a variety of enlargements and contrasts to see whether the pictures from the antimatter telescope contained focused images absent in the pictures from the Galileo telescope under the same enlargement and contrast.

Following the availability of the so mounted and aligned pair of telescopes, Santilli initiated night views by first confirming that, as expected, any celestial object visibly focused by the Galileo telescope was not focused at all with the antimatter telescope. In particular, the view of details of our Moon, which were very nicely focused by the Galileo telescope, resulted in a diffuse light when seen from the antimatter telescope without any possible identification. The same occurred for planets and nearby matter stars. Then Santilli finally initiated preliminary views of the sky at night with said pair of telescopes. He reported the tests conducted at the Gulf Anclote Park, Holiday, Florida, GPS Coordinates: Latitude = 28.193, Longitude = - 82.786. The camera was set at the exposure of 15 seconds for the specific intent of having streaks of light from far away matter stars caused by Earth rotation, since streaks can be better identified with the limited capabilities of the available telescopes compared to individual dots of light in the pictures. Additionally, streaks from matter stars have a clear orientation as well as length that are important for the identification of possible streaks from antimatter light. Following various tests, he selected the 10 setting of the camera at ISO 1600 because various tests with smaller and bigger ISO resulted inconclusive and ambiguous for various reasons. All pictures were analyzed with particular reference to the identification of the background as well as impurities in the camera sensors that are evidently present in both pictures from the Galileo and the Santilli telescope [25].

6. Results and Discussion

The primary objective was to see whether or not antimatter galaxies can be detected with the concave lens telescope (Santilli telescope). since the identification of their precise location was quite unrealistic for these initial tests due to the current complete lack of knowledge of the optics of antimatter light.

Santilli initiated night views by first confirming that, as expected, any celestial object visibly focused by the Galileo telescope was not focused at all with the antimatter telescope. In particular, the view of details of our Moon, which were very nicely focused by the Galileo telescope, resulted in a diffuse light when seen from the Santilli's antimatter telescope without any possible identification. The same occurred for planets and nearby matter stars.

Following the above preparatory steps, he finally initiated preliminary views of the sky at night with said pair of telescopes. Among a variety of tests he report the tests conducted between 10 and 11 pm of November 7, 2013, at the Gulf Anclote Park, Holiday, Florida, GPS Coordinates: Latitude = 28.193 , Longitude = - 82.786.

The camera was set at the exposure of 15 seconds for the specific intent of having streaks of light from far away matter stars caused by Earth rotation, since streaks can be better identified with the limited capabilities of the available telescopes compared to individual dots of light in the pictures. Additionally, streaks from matter stars have a clear orientation as well as length that are important for the identification of possible streaks from antimatter light. Following various tests, he selected the 10 setting of the camera at ISO 1600 because various tests with smaller and bigger ISO resulted inconclusive and ambiguous for various reasons.

All pictures were analyzed extensively with particular reference to the identification of the background as well as impurities in the camera sensors that are evidently present in both pictures from the Galileo and the Santilli's antimatter telescope.

Following these preliminaries, he oriented both telescopes at the indicated location and time toward the star Vega, and then specialized the orientation for the pair of matter stars Epsilon Alpha and Epsilon Beta near Vega. Some of the pictures taken by Galileo and Santilli telescopes of matter and antimatter galaxies respectively are shown in Figures 1 and 2 [16].

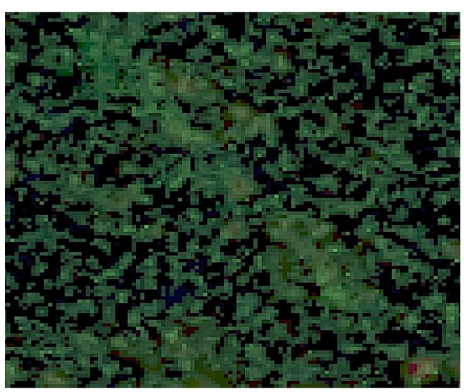
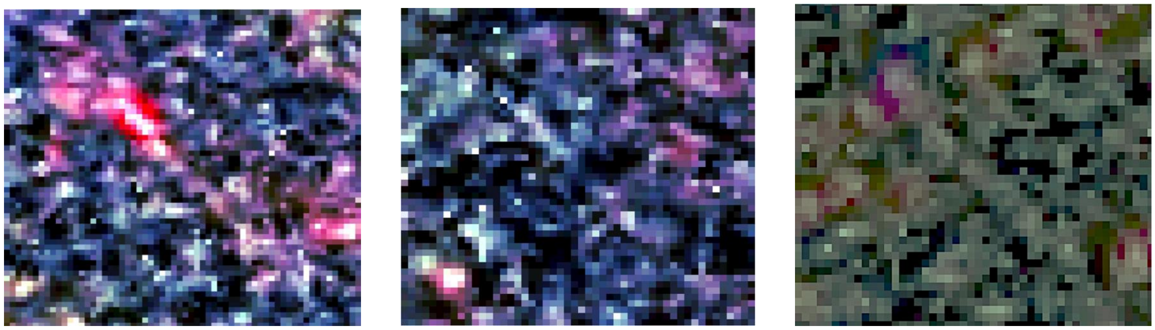
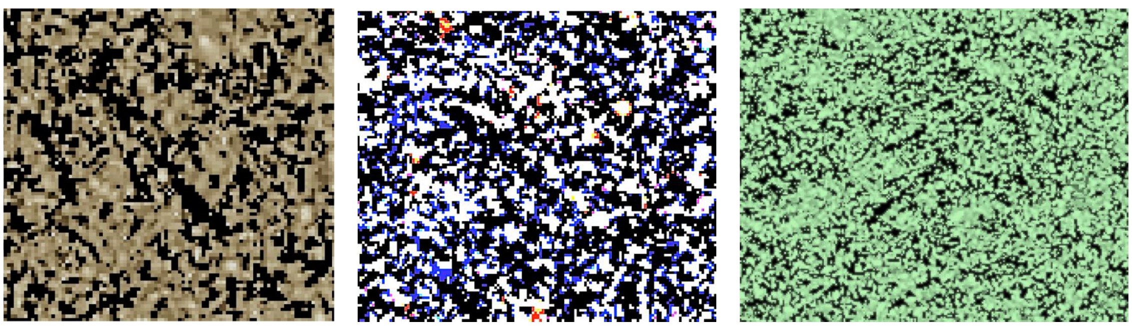


Figure 10: View of one of the streaks of matter light representing a far away matter star or galaxy identified in the Epsilon Alpha and Beta region of the night sky near Vega via the Galileo telescope [16]



(a) (b) (C)

Figure 11: Views of (a) First Streak, (b) Second streak and (c) Third streak of light detected in the Epsilon Alpha and Beta region with the Santilli telescope of antimatter galaxies [16]



(a) (b) (c)

Figure 12: (a)The first streak of darkness identified in the picture of the Epsilon Alpha and Beta region of the night sky taken on November 7, 2013, with the antimatter telescope providing possible evidence of a far away antimatter star or galaxy as an alternative for the streaks of light.
(b) Another representative streak of darkness present in the antimatter telescope but absent in the Galileo telescope that may constitute an alternative to the streak of light.
(c) Seemingly connected streaks of darkness identified in a picture of the Vega region of the night sky on November 7, 2013, with the antimatter telescope that could be due to the annihilation of a shower of small antimatter asteroids in our atmosphere, in a way much similar but the conjugate of the frequent view in the night sky of the streaks of light caused by the annihilation of a shower of small matter asteroids in our atmosphere. [16]

In order to properly interpret expected anomalies in the pictures, we should recall the following properties of the isodual theory of antimatter [4]. As indicated in Sect. 3, isodual mathematics predicts that antimatter possesses *negative energy* according to Dirac's original conception [5], although referred to a *negative units* of energy when considered in the antimatter world.

When antimatter is considered in the matter world represented with a conventional Hilbert state $|\rangle$, a first line of current thinking is that the energy of antimatter is positive. This view can be represented via the isodual eigen value equation $H^d \, x^d \, |\rangle = E \ x \ |\rangle$, $E > 0$, where x^d is the product in the antimatter world. In this case, antimatter light hitting the pixels of the camera should produce the same voltage and, therefore, the same image as those of matter light. Hence, we first looked for ordinary streaks of light that are present in the pictures from the antimatter telescope but absent in the Galileo telescope. In particular, he used a camera exposure causing a streak of light sufficiently long to be clearly distinguishable from the background. However, the knowledge of antimatter is extremely limited. Therefore, we have to consider for completeness the possibility that antimatter light is received by the camera pixels as having a negative energy from the alternative eigen value equation $H^d x |> = -E x |>$, $E > O$, where "x" is now the product in our matter world as requested by isodual mathematics. In this second case, antimatter light hitting the pixels of the camera are expected to produce a voltage opposite that of matter light, thus causing a streak of darkness, rather than light. This suggested the additional search for streaks of darkness that are present in the pictures from the antimatter telescope but absent in those from the Galileo telescope. In regard to the alternative of streaks due to positive or negative energies, we should recall that the invariance under isoselfduality requires that matter-antimatter annihilation jointly produces matter and antimatter light. This can be seen from the conventional particle reaction $e^+ + e^- \rightarrow \gamma + \gamma$ in which isoselfduality is verified in the left but not in the right side. The verification of isoselfduality for both sides then requires the revised formulation $e^+ + e^- \rightarrow \gamma + \gamma^d$ resulting in the indicated production of two lights [17].

Consequently, any confirmation that antimatter light has a negative energy, either via the pictures presented here or via the possible experimental detection of gravitational repulsion for antimatter light in a matter field, would confirm Dirac's original conception of antiparticles as having negative energy [5] while isomathematics would resolve known inconsistencies.

Following the above clarifications for a tentative interpretation of expected anomalies, it is provided in Ref. [27] the main picture of the indicated Epsilon Alpha and Beta region of the sky from the Galileo telescope in both compiled and raw forms, where one can easily identify the Epsilon Alpha and Epsilon Beta pair of matter stars near Vega.

Fig. 10 provides the typical view of a far away matter star or galaxy in the indicated region of the sky which view can be easily identified in the main picture of Ref. [27] under suitable magnification. One should note the length and orientation of the streak of light of Fig. 10 due to Earth's rotation during the 15 second exposure, as well as its weakness due to the fact that the sky was inspected in an essentially urban area with consequential unavoidable diffuse luminescence. An additional reason for the weakness of the streak is that the tests were conducted at the Gulf Anclote Park which is at the edge of the Gulf of Mexico, thus implying significant humidity of the air, with ensuing additional weakness of the streaks of light due to water absorption of light. It should keep in mind these limitations so as to avoid the expectation of the detection of brilliant streaks of light in the Santilli's antimatter telescope.

In Ref. [28] the compiled and raw forms of the corresponding pictures of the same region of the sky from the Santilli's antimatter telescope are provided.

As indicated above, in our analysis of the latter picture, Prof. Santilli first identified streaks of light reported in Figs. 11(a, b and c) that are present in the Santilli's antimatter telescope but can arguably be conceived as being absent in the Galileo telescope. The magnification has been obtained via the Gimp 2.8 software. The position of the anomalous streaks of light of Figs. 11(a, b and c) is indicated with squares in the main picture visible under no magnifications. The anomalous streaks of light will then appear under suitable magnification.

It should be noted that streaks of light are of difficult identification, particularly for their corresponding absence in the Galileo telescope since the background is also made up of light. Prof. Santilli indicated them in representation of the current first line of thinking that antimatter light, and therefore antiparticles, have positive energy.

It should also be noted that the focal position of the camera was accurately marked in the transition from the Galileo to the Santilli's antimatter telescope, but not its angular orientation due to the primitive character of the available equipment, thus implying possible small differences in orientation of the streaks in the Galileo and Santilli's antimatter telescopes. Hence, expectations of extreme accuracy in the orientation of the matter and antimatter streaks would be unrealistic for these first tests.

As indicated above, Prof. Santilli additionally conducted a search for streaks of darkness in the main pictures of the indicated Epsilon Alpha and Beta region of the night sky from the antimatter telescope under the conditions that: 1) said streaks are present in the Santilli's antimatter telescope but not in the Galileo telescope; 2) the streaks have approximately the same orientation and length of the streak of matter light of Fig. 10; and 3) the streaks are clearly distinguished from the background. Note that, since the background is predominantly that of light, streaks of darkness are more distinguishable than those of light, thus being less controversial.

Two representative streaks of darkness verifying these requirements are reported in Figs. 12 (a and b). Note the apparent clear organization of dark pixels over illuminated ones with a low statistical probability if occurring at random. The streaks of Figs. 12 (a and b) are here tentatively presented as providing possible evidence, following due verifications, that antimatter light may cause focused images of darkness when hitting the pixels of the selected camera (that was evidently produced to detect matter light).

In Fig. 12 (c) Prof. Santilli present seemingly correlated streaks of darkness of unknown origin, but which could be arguably due to a shower of small *antimatter asteroids* annihilating in or passing through our upper atmosphere. This is due to the fact that their orientation is not compatible with that caused by the fifteen second exposure of the camera as set by the streak of Fig. 10, thus solely allowing for interpretation an essentially instantaneous event.

It should be noted that Prof. Santilli could locate no additional, clearly identified streaks of light or darkness in pictures of various regions of the sky obtained with the Santilli's antimatter telescope besides the streaks reported in Figs. 11 (a, b, c) and 12(a, b, c), although the search was at random and definitely not systematic. Arguably, the absence of additional streaks besides those of the Epsilon Alpha and Beta region could be due to the fact that possible antimatter galaxies are too much far away for the very limited possibilities of the used 10 cm telescopes, thus Prof. Santilli suggested the construction of a bigger pair of Galileo and Santilli's antimatter telescope for their possible detection.

Besides said linear streaks, Prof. Santilli has identified numerous, completely unexpected *circular traces* in pictures of the Epsilon Alpha and Beta region as well as in other regions of the night sky, which traces are present in the Santilli's antimatter telescope but not in the Galileo telescope. Representative examples of these circular traces are reproduced in Figs. 13 to 17. As one can see, these circular traces all have approximately the same diameter for a given magnification; and are clearly distinct from the background.

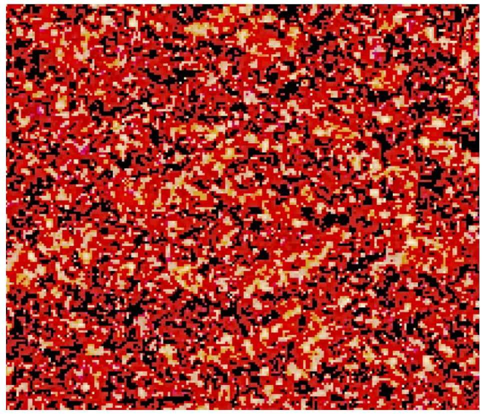


Figure 13: The first of numerous circular traces identified in a picture of Vega regions of the night sky on November 7, 2013, with the Santilli's antimatter telescope that could be due to the annihilation of an antimatter cosmic ray

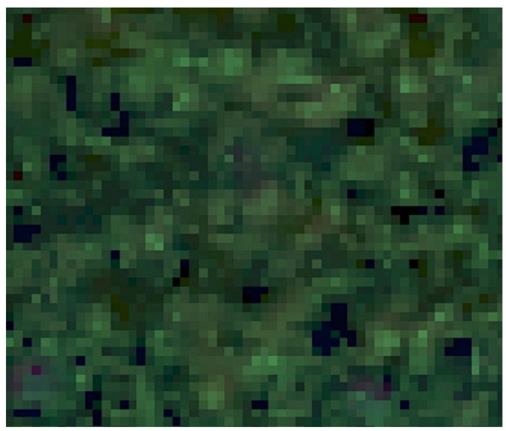


Figure 14: View of a circular trace identified in a picture of Deneb regions of the night sky with the Santilli's antimatter telescope.

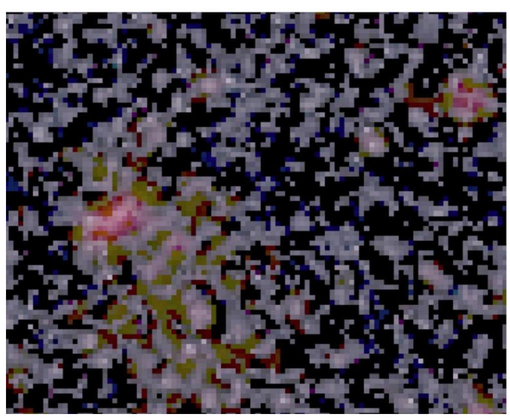


Figure 15: View of a circular trace identified in a picture of Altair regions of the night sky with the Santilli's antimatter telescope.

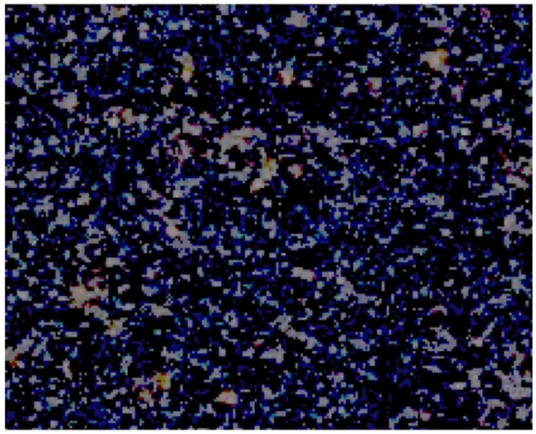


Figure 16: View of a circular trace identified in a picture of Sadr regions of the night sky With the Santilli's antimatter telescope.

Figure 17: View of a circular trace identified in a picture of Gienah Cyngi regions of the Night sky with the Santilli's antimatter telescope.

After due analysis, it is possible that these circular traces might be due to the annihilation of *antimatter cosmic rays* in the upper region of our atmosphere, thus yielding approximately the same diameter of the trace at sea level due to the same travel in air. This interpretation is also suggested by the fact that the circles show no motion during the fifteen seconds of exposure, thus implying extremely fast events. An additional aspect supporting the indicated interpretation is the variety of the circular traces identified by Prof. Santilli in numerous regions of the sky.

It can be argued that, during the annihilation, of possible antimatter cosmic rays in our atmosphere matter light may quickly dissipate in the atmosphere, while antimatter light may continue its path along the original direction. The detected circles might then characterize, in reality, a cone of antimatter light.

In the event confirmed, these circular traces would be the first detection at sea level of the flashes of light seen by astronauts and cosmonauts in the upper dark side of our atmosphere. Note that, again in case of verifications, the flashes seen by astronauts and cosmonauts would only be originated by matter light due to the convex character of our iris, while our view at sea level would be due to antimatter light seen via concave lenses.

Note that the circular traces could also be due to antimatter gamma rays, their arrival at sea level in the forms of cones being possibly due to effects inherent in the yet unknown optics of antimatter light.

As one can see, the circular traces appear to be predominantly, but not definitely due to *circles of darkness,* rather than light. Consequently, *the circular traces of darkness of* Figs.13 to 17 *support the hypothesis that antimatter light causes images of darkness, rather than light, in a camera built for matter light, thus supporting the view that antimatter light has negative energy when detected in our world.*

Also, *a photographic analysis of the streaks of light in* Figs. 11(a, b and c) *reveals that each streak is in reality supported by a background of darkness, the organization of some of the pixels to produce a streak of light being possibly due to a yet unknown effect of the yet unknown antimatter optics. Consequently, it appears that, under a deeper analysis, even the streaks of apparent light may support a negative energy for antimatter light when detected in our world.*

A resolution of the alternative between images of light or darkness suggests a special camera with inverted sign of the pixel voltage, or other means under which matter light is detected as darkness in order to see whether antimatter light produces visible images. Needless to say, the construction of such a special camera should be complemented with the construction of bigger and more accurate pair of Galileo and Santilli's antimatter telescopes.

There is no doubt that, besides the above proposed special camera and bigger telescopes, a considerable amount of additional mathematical, theoretical and experimental research is needed for the resolution of the background central issues: whether matter-antimatter annihilation verifies the symmetry of isoselfduality; whether annihilation jointly produces distinct matter and antimatter light; and whether antimatter and/or light experiences gravitational repulsion in a matter field.

Among the needed research, Prof. Santilli indicate: the great need to develop the *antimatter optics,* also called by the author *isodual optics* [17]; the measurement of the gravity of the positron in horizontal flight in a super vacuum and super cooled tube [4, 13, 29]; and the experimental resolution whether the two photons emitted in the electron-positron annihilation $e^{+} + e^{-} \rightarrow \gamma + \gamma^{d}$ both experience gravitational attraction, or one experience attraction and the other repulsion. Until all this basic knowledge is achieved, any resolution of the origin of the anomalous streaks and circles reported here, whether in favor or against, will be purely illusory.

7. Preliminary Experimental Confirmations of Antimatter Detection using Santilli's Antimatter Telescope

By using the same pair of Galileo and Santilli telescopes, the same camera, the same exposure of 15 seconds for ISO 1600, on November 30, 2013, a team of scientist went to Sebring, Florida (an area of central Florida known to astronomers for the clarity of the sky due to the absence of nearby large cities) and obtained pictures from both telescopes of the same region of the night sky studied by Santilli (that of Epsilon Alpha and Beta stars).

Some of the original pictures are available from Ref. [30] in raw and tiff formats under the markings "Galileo-Epsilon-Sebring" and "Santilli-Epsilon-Sebring." Figs. 18 to 21 reports selected joint views from the Galileo and the Santilli telescopes showing clearly anomalous streaks that are present in the Santilli telescope but absent in the

Galileo telescope, which streaks have essentially the same orientation and length of the streaks caused by matter stars, thus confirming the corresponding anomalous streaks first obtained by Santilli in a telescope with concave lenses i.e. Santilli's antimatter telescope.

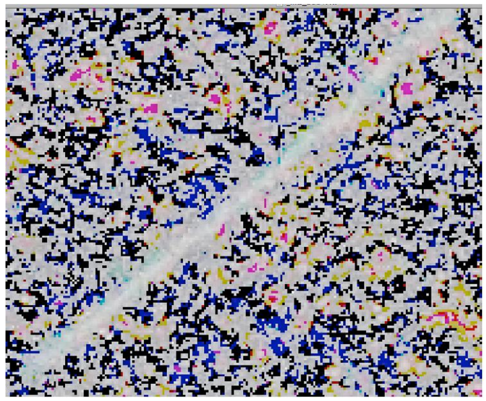


Figure 18: Picture from the Galileo Telescope of a star in the Epsilon region of the sky from Sebring, Florida.[18]

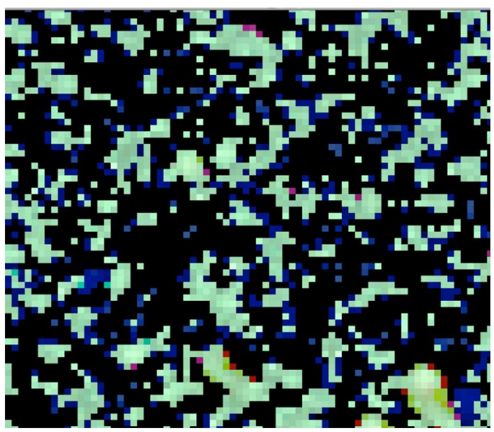


Figure 19: Picture from the Santilli telescope of a black streak in the Epsilon region of the sky from Sebring, Florida. [18]

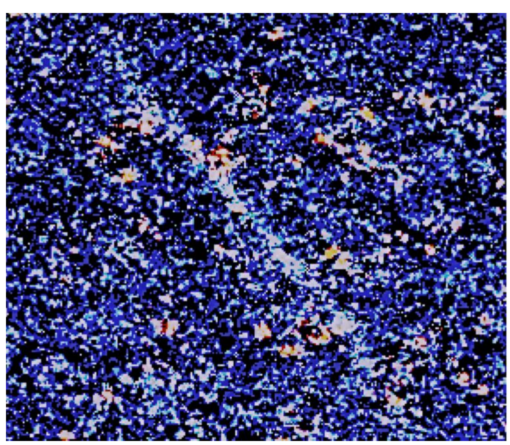


Figure 20: Picture from the Galileo telescope of a star from the Epsilon region of the sky from Sebring, Florida. [18]

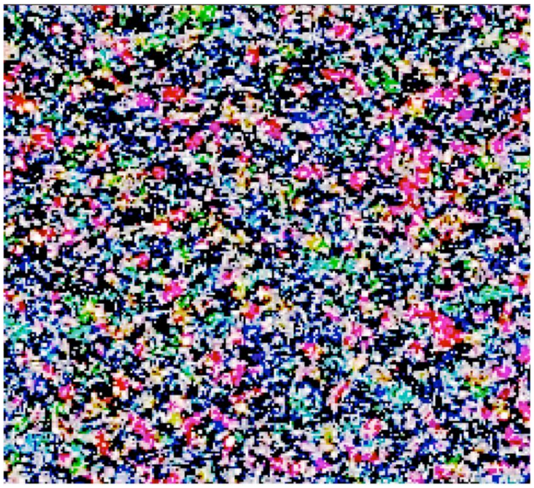


Figure 21: Picture from the Santilli telescope of a black streak in the Epsilon region of the sky from Sebring, Florida. [18]

On December 4, 2013, by also using the same telescopes, the same camera and the same settings, the same team of scientist went to Enclote Gulf Park in Holiday, Florida, where Prof. Santilli achieved his original findings, and obtained pictures of the Vega region of the night sky that includes that the Epsilon Alpha and Beta stars.

Representative pictures of these second tests are also included in Ref [30] indicated as "Galileo-Vega-Holiday" in both raw and tiff formats, and "Santilli-Vega-Holiday" also in both raw and tiff formats. Anomalous streaks from these latter tests which are present in the Santilli telescope but absent in the Galileo telescope are reported in Fig. 23 and 24 by showing remarkable similarity in orientation and length with the streak caused by a matter star or galaxy of Fig. 22, thus providing additional confirmation of the anomalous streaks obtained by Prof. Santilli in a telescope with concave lenses i.e. Santilli's telescope.

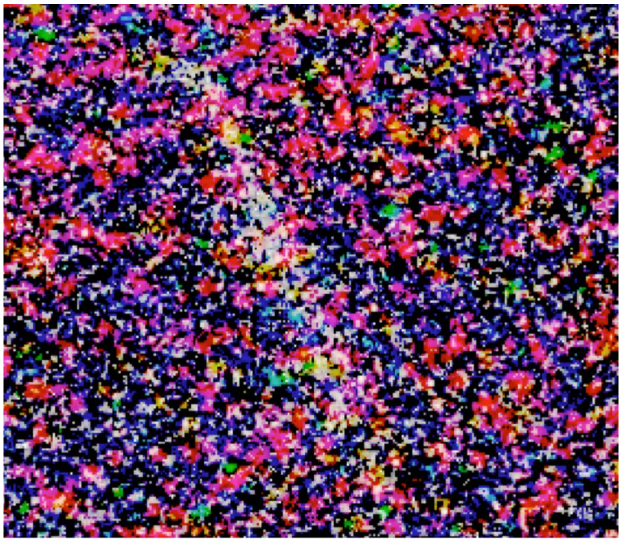


Figure 22: Picture from the Galileo Telescope of a streak of a matter star in the Vega region of the sky from Holiday, Florida.

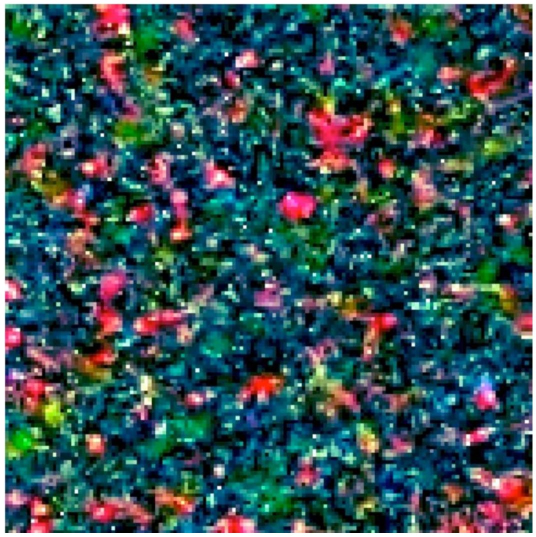


Figure 23: Picture from the Santilli telescope of a black streak in the Vega region of the sky from Holiday, Florida.

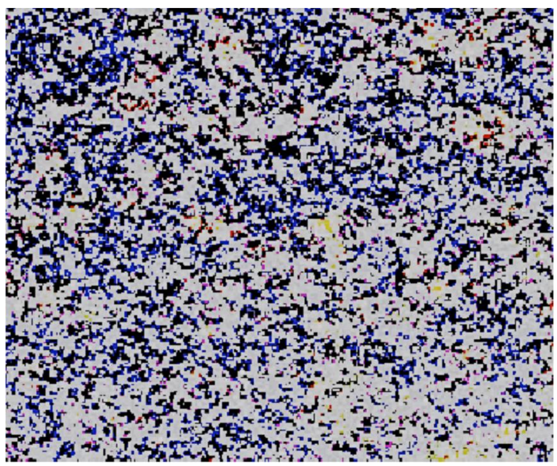


Figure 24: Picture from the Santilli telescope of another streak in the Vega region of the sky from Holiday, Florida.

As one can see, also in confirmation of the results of ref. [4], all the anomalous streaks from the Santilli telescope are predominantly streaks of darkness, rather than light over a background of matter light. Therefore, in the event confirmed, the anomalous streaks of pictures 18 to 24 appear to confirm the apparent detection of antimatter galaxies.

In Fig. 25 shows an additional quite anomalous black streak of unknown identification present in only one of the pictures from the Santilli telescope in the Epsilon region of the sky viewed from Sebring, Florida., which anomalous trace is absent in the Galileo picture of the same area of the sky. Due to its orientation being different than that of the streaks of matter stars of Fig. 18, and its shortness despite the 15 seconds exposure, it is argued that this streak may be due to a small antimatter asteroid annihilating in the upper region of the our atmosphere. The significance of the anomalous trace of Fig. 25 is due to its size and quite distinct darkness over the background of matter light.

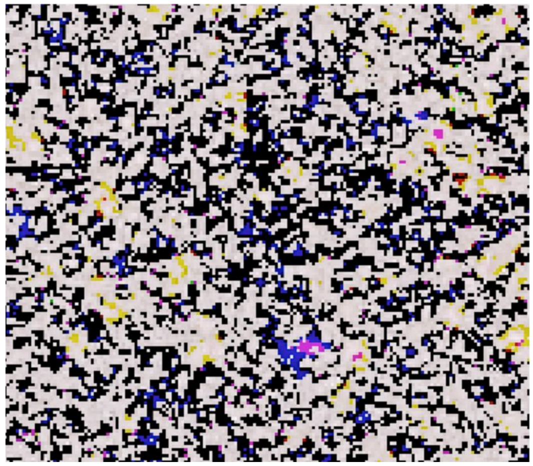


Figure 25: Picture from the Santilli telescope of an unknown event in the Epsilon sky region from Sebring, Florida.

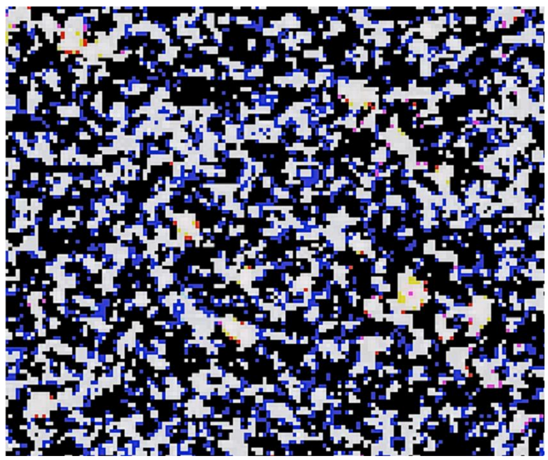


Figure 26: Picture from the Santilli telescope of a circular trace.

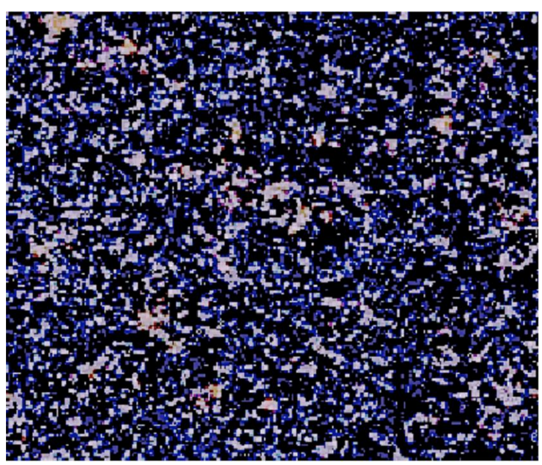


Figure 27: Picture from the Santilli telescope of another circular trace.

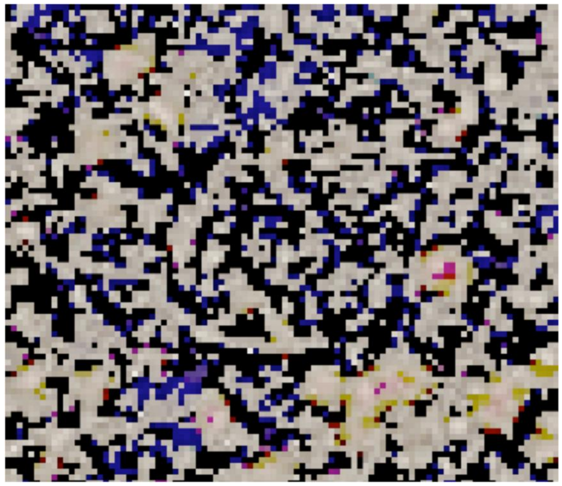


Figure 28: Picture from the Santilli telescope of yet another circular trace.

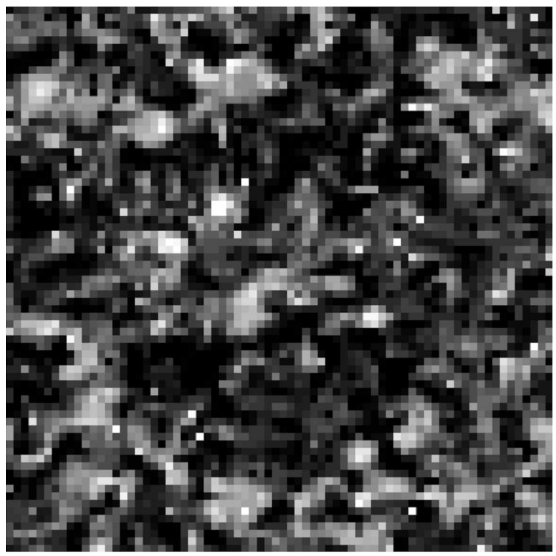


Figure 29: Picture from the Santilli telescope of yet another circular trace.

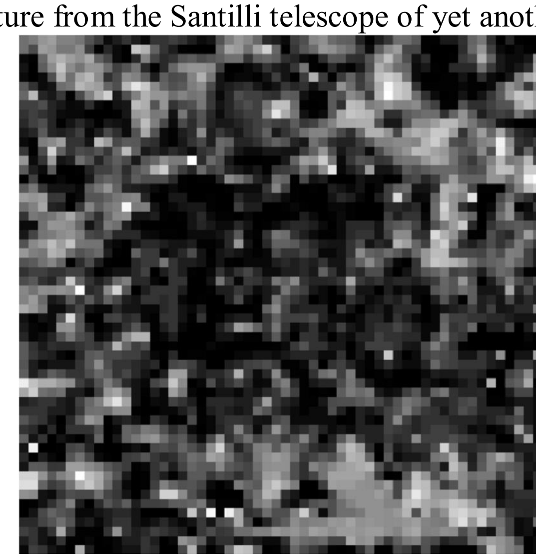


Figure 30: Picture from the Santilli telescope of yet another circular trace.

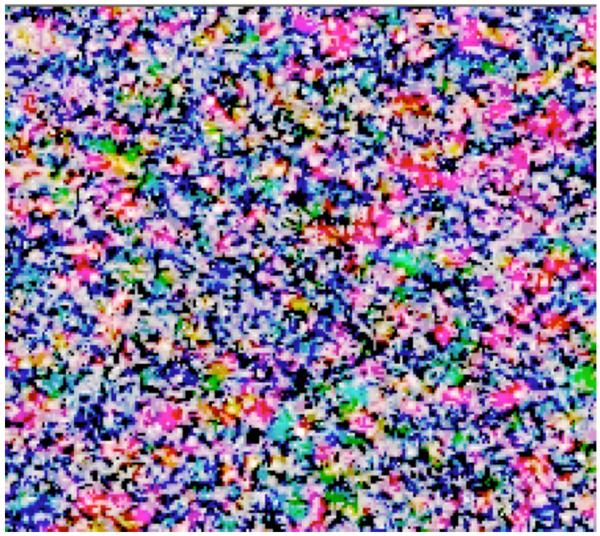


Figure 31: Picture from the Santilli telescope of yet another circular trace.

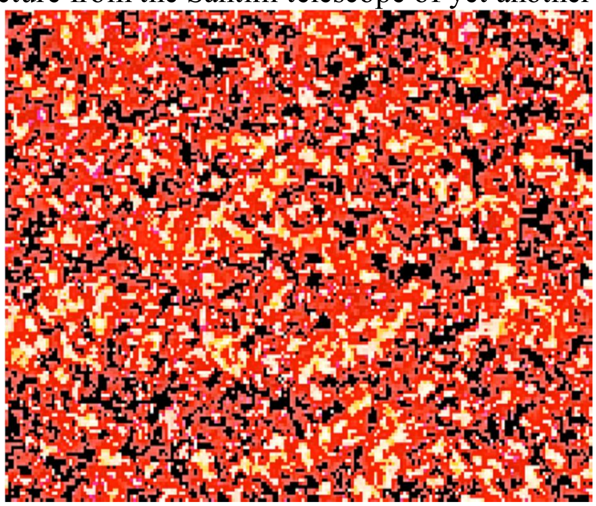


Figure 32: Picture from the Santilli telescope of yet another circular trace.

In Figs. 26 to 32 team of scientist reported confirmation of the circles in the Santilli telescope, not present in the Galileo telescope, first detected by Prof. Santilli [16], including the confirmation that they all having approximately the same diameter under the same magnification, they are predominantly due to darkness, rather than matter light, and they occur at random in various parts of the night sky.

8. CONCLUSIONS

In the event confirmed, the anomalous traces reported by Santilli may emerge as being the first experimental apparent detection of antimatter galaxy, antimatter asteroids and antimatter cosmic rays. The isodual light has negative energy and possesses a negative index of refraction when propagating within a transparent matter medium as predicted by Santilli isodual mathematics. Apparent detection of antimatter galaxies is possible by the refractive telescope with concave lenses as constructed by Santilli known as Santilli telescope; which follow the concept of negative energy and negative index of refraction. Santilli telescope can focus images of far away light sources that can only be due to antimatter galaxies. Santilli telescopes detect anomalous traces that can arguably be due to small antimatter asteroids annihilating in the upper portion of our atmosphere. Santilli telescope also detects numerous anomalous circles that are at random, in the night sky and have approximately the same diameter under the same magnifications, suggesting the detection at sea level of antimatter light originating form the annihilation of antimatter cosmic rays in the upper region of our atmosphere. All anomalous traces are predominantly due to darkness, rather than light, over a background caused by matter light. The sole known interpretation of dark images in a camera built for matter light is that antimatter light possesses negative energy, thus confirming the main result of Ref. [16], namely, Dirac's original conception of antiparticles as having negative energies.

Based on the presented results and discussion, the first apparent detection of antimatter galaxies by Santilli's antimatter telescope is thus then confirmed.

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