STUDY OF MATHEMATICAL, THEORETICAL AND EXPERIMENTAL CONFIRMATIONS OF IRS AND IBS BY R. M. SANTILLI

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Abstract

The objective of present work is to put forward the Santilli's basic theoretical conventions, his key findings, his research drilldown and experimental confirmations of IsoRedShift (IRS), IsoBlueShift (IBS) and NoIsoShift (NIS) with the appropriate mathematical formulations renown as Santilli's Isomathematics. Prof. Santilli has carried out a step-by step isotopic lifting of the physical laws of special relativity resulting in a new theory today specifically known Santilli isorelativity.In his 1991 hypothesis Santilli established the requirement to realize the light as electromagnetic waves propagating within a universal substratum.Santilli's studies have presented a significant reconsideration of the special theory of relativity.Prof.Santilli accomplished an efficient measurements and established that while light traverses from Zenith to the Horizon, the entire spectrum of Sunlight experiences an IRS.In this work we have concentrated on concurrence of Santilli's IRS and IBS with the adages of special relativity beneath their appropriate mathematical interpretations.Besides we focused on the innovative experimental verifications of IRS by Santilli.

Keywords: IsoRedShift, IsoBlueShift, NoIsoShift

1 Introduction

A fundamental prediction of special relativity was established by Doppler Red shift which states that,when the light source travels away from the observer, the frequency of light f is shifted toward the red. According to Santilli's theoretical and experimental confirmations it has been observed that light propagating within a physical medium experiences a redshift without any relative motion between the source, the medium and the observer [1]. According to Santilli's isorelativity, quasar cosmological redshifts and their internal red and blue-shifts are because of interior physical distinctiveness of the quasars chromospheres and, in particular, to their inhomogeneity and anisotropy, specifically, to the departures from the geometry of empty space occurring within physical media. More willingly, Santilli has personalized the theory to experimental confirmation and presented a significant reconsideration of the special theory of relativity [2]. After the successful experimental measurements,Santilli released the results for publication [3] and has put accent on the main scope of the measurements which was initiated to confirm the existence of the IRS, without any possibility of conducting statistical averages. Prof. Santilli conducted his mathematical, theoretical and experimental studies for interior dynamical problems and confirmed that light propagating within the physical media admits IsoRedShift (IRS) and IsoBlueShift (IBS). In general, electromagnetic waves and particles propagate exclusively within the anisotropic and inhomogeneous physical media. A prime variance between interior and exterior systems is presence in the form of contact, non-local, non-linear and non-potential interactions that cannot be steadily represented via a Hamiltonian or a Lagrangian formulation. Additionally, the literature surveys make known that Lorentz symmetry is not precisely applicable within a physical media and it prerequisites reliable simplification for exterior dynamical problems. The Minkowskian geometry and special relativity is valid only for exterior dynamical problems(e.g.,electromagnetic waves propagating in vacuum and point particles). Nevertheless for the duration of past fifty years, research accompanied by large number of researchers, has acknowledged mathematical, theoretical, experimental, physical, chemical and industrial confirmation and accordingly we now recognize that the special relativity and Minkowskian geometry are not specifically applicable [4] for interior dynamical problems [5]. Through the 20^{th} century propositions, these insufficiencies were apparently removed by the way of reduction of light to photons traveling in empty space and be subjected to scattering,absorption

and reemission by the atoms of the medium.The present work is an attempt to present professor Santilli's view point on Isoredshift (IRS) and Isoblueshift (IBS) by considering his step by step mathematical and experimental justifications [6].

2 Basic Theoretical Conventions

The preceding predictable laws by E. Hubble [7], V. Slipher [8] presented reveals that the cosmological redshift of galactic light is proportional to the distance of galaxies in "all" radial directions from Earth, and the redshift essentially occurs for "all" frequencies of galactic light. Instantaneously after above discovery, F. Zwisky [9] submitted the hypothesis according to which the cosmological redshift is due to light losing energy because of scattering with the intergalactic medium. It is known that the only quantitative representation of all experimental evidence for all frequencies is given by the Maxwell's concept of light. The transverse electromagnetic waves propagating in the universal substratum is given by historical expression for its speed within transparent physical media as, $C = c/n(x, \nu, \omega, \delta, ...)$, where c is the velocity of light in vacuum and n is the index of refraction. This expression depends on all local variables, such as coordinates x, speed ν, frequency ω, density δ, temperature T, etc. However Lorentz first attempted to establish the universal symmetry of local speeds $C = c/n(x, \nu, \omega, \delta, T...)$ and came across the major technical difficulties by considering the simpler case of constant speed c which sets aside the foundations of special relativity [10]. Afterward Prof. R. M. Santilli came to conclusion that the problem considered in Lorentz's theory is generally nonlinear, nonlocal-integral and non-Hamiltonian. Consequently, in 1996 Prof. R. M. Santilli had constructed a new mathematics applicable within physical media known as Santilli isomathematics which is specifically built for interior dynamical problems. This isomathematics is based on the locally varying speed of light $C = c/n(x, \nu, \omega, \delta, T...)$, which is today known as the Lorentz-Poincare-Santilli (LPS) isosymmetry and the isotopeis of this special relativity known as Santilli isorelativity [11]. During past fifty years research conducted by large number of researchers, has identified mathematical, experimental, physical, chemical and industrial confirmation that,

1. **the Minkowskian geometry** and special relativity are not precisely applicable for interior dynamical problems (e.g., electromagnetic waves

propagating within physical media and extended-deformable particles) [12].

2. **the Minkowskian geometry** and special relativity is valid only for exterior dynamical problems (e.g., electromagnetic waves propagating in vacuum and point particles.)

3. **the Lorentz symmetry** is not exactly applicable within a physical media and it needs consistent simplification for exterior dynamical problems.

4. **special theory** of relativity was not precisely applicable [12] for interior dynamical problems.

Until the early part of 20^{th} century, there was a clear distinction between interior and exterior Dynamical Problems.
Interior Dynamical Problems: Referred to extended particles and electromagnetic waves propagating within physical media
Exterior Dynamical Problems: Referred to systems of point-particles and electromagnetic waves propagating in empty space A primary difference between interior and exterior systems is appearance in the form of contact, non-linear, non-local and non-potential interactions that cannot be consistently represented via a Hamiltonian or a Lagrangian formulation.

3 Paradoxycal inconsistencies of special relativity in our atmosphere

The visual evidence of the pictures in which one can see the transition of the color at the horizon from Blue during the day to Red at night (Figure 1). First pictures on the predominant blue color of the sky when the Sun is at the Zenith establishes that all remaining colors of Sun light are absorbed by our atmosphere, as confirmed by relativistic quantum scattering theories for which absorption is proportional to the wavelength. In fact, the widespread belief is that at Sunset and Sunrise we have the absorption of all colors except red. But at the horizon we have the longest propagation of light in atmosphere. And at Sunrise we are more 'away' from the Sun,therefore according to the shift law of special relativity, the predominant color should be dark blue and definitely not red.

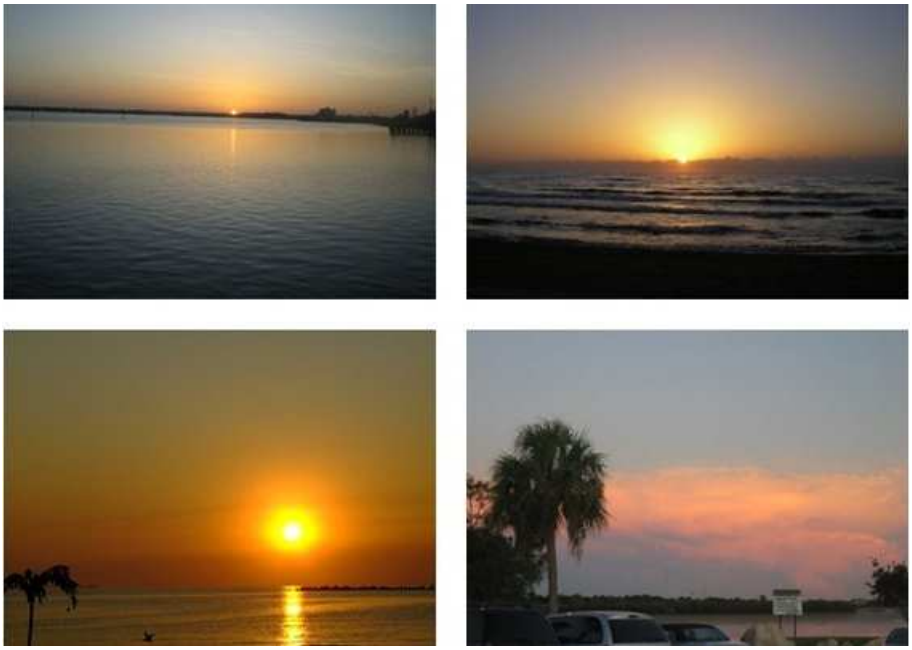

Figure 1: The visual evidence of the pictures in which one can see the transition of the color at the horizon from blue during the day to red at night.

4 Santilli's Experimental Confirmations of IsoRedShift

The novel isomathematics, related geometries and physical formulations for non relativistic and relativistic, classical and operator formulations for interior dynamical problems have nowadays experimental verifications in all quantitative sciences, including classical physics,particle physics, nuclear physics, super-conductivity, chemistry, biology, astrophysics and cosmology. Almost after two consequent decades of refusals Santilli decided to conduct the needed experimental measurements since he had no other choice to demonstrate these fundamental implications. Consequently, with the assistance of the technicians at the Institute for Basic Research in Florida, as well as the support of external laser experts, Santilli constructed the IsoShift Testing Station (Figure 2) consisting an initial air-conditioned cabin containing a blue laser; a second air-conditioned cabin containing wavelength analyzers; the laser and analyzer being interconnected by a 60 ft $\approx$ 18 m long steel

pressure pipe containing air at the maximal pressures up to 2000 psi $\approx$ 137 bars. After several months of successful measurements, Santilli released the results for publication [13] and put the accent on the main scope of the measurements which was establish to confirm the existence of the IRS (Figure 3), without any possibility of conducting statistical averages with the available experimental set up.

Figure 2: A view of the IsoShift Testing Station built by Santilli and his technicians in early 2009.

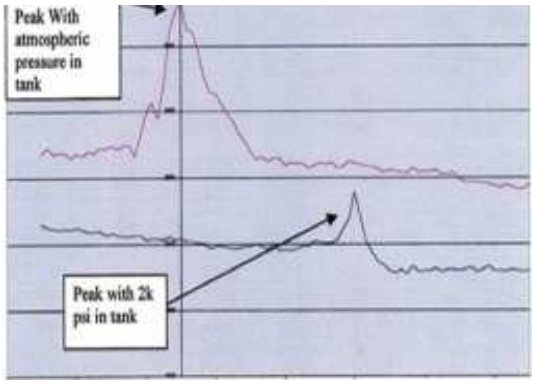

Figure 3: A view of the first measurement of a deviation from Doppler's law in our atmosphere in favor of the IsoRedShift achieved by Santilli in June 15, 2009 [14]

The measurements in this particular confirmation recognized that the entire spectrum of Sunlight experiences a shift toward the red for about 100

nm, plus there is the appearance of about 100 nm in the infrared at the horizon that was not present at the Zenith.The measurements were conducted at the St. Petersburg Beach, Florida West Coast, also from the Zenith to the horizon, and at the same sequence of elevation over the horizon as done for the Yokogawa analyzer(Figure 4). Analysis of the new raw data was also done with the same methods as those used for the preceding measurements. Furthermore clear confirmation of the chromatographic analysis conducted in Florida using the Avantes wavelength analyzer model AvaSpec-ULS 2048 (Figure 5). One of the most important consequences of this measurements is to provide an additional experimental confirmation of the mutation of the Minkowski spacetime for the vacuum into the covering Minkowski-Santilli isospacetime for our atmosphere, with consequential applicability of the covering LPS isosymmetry and related isorelativity.

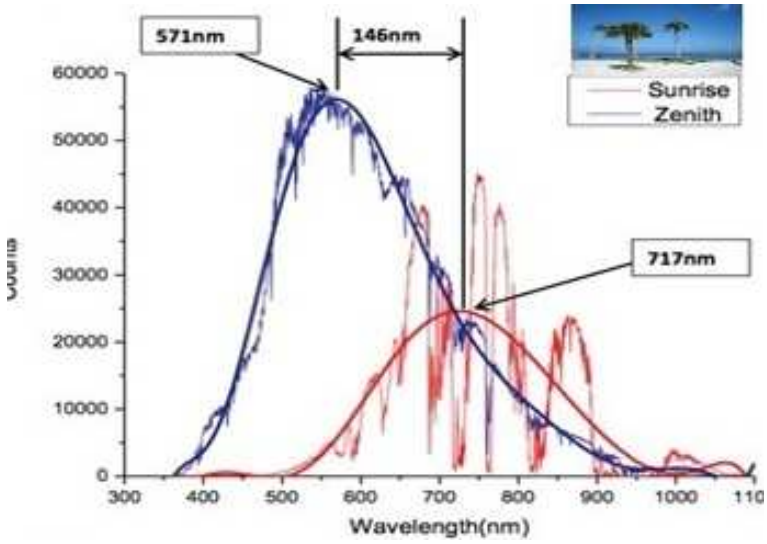

Figure 4: Chromatographs of Sunlight from Sunrise to the Zenith obtained for the first time by the authors on October 20, 2012, at Cocoa beach in the East Coast of Florida.

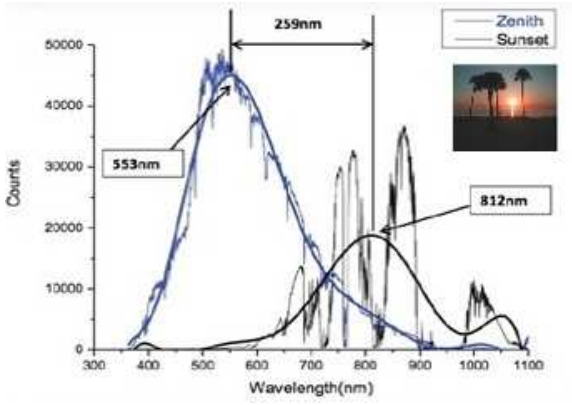

Figure 5: Representative chromatographs of Sunlight from the Zenith to the horizon obtained on September 20, 2012, at the island of Kos, Greece.

5 Mathematical Background

Prof. R. M. Santilli had spent years of studies for the construction of an innovative mathematics appropriate inside physical media that was finally achieved in journal [15] of 1996, and is today known as isomathematics, where the prefix "iso" indicates the conservation of the original adages.He had dedicated his further years of research to the construction of the isotopies of Lie's theory, today it is known as the Lie-Santilli isotheory [15, 16]. Merely following the entire studies, Santilli was in a position to construct the universal invariance of the locally varying speed of light, which is today known as the Lorentz-Poincare-Santilli (LPS) isosymmetry, besides the isotopeis of special relativity known as Santilli isorelativity [15, 16]. In general these studies are currently raised to the invariance of the following most general possible symmetric line element in (3+1)-dimensions

$$x^2 = \frac{x_1^2}{n_1^2} + \frac{x_2^2}{n_2^2} + x_3^2 n_3^2 - t^2 \frac{c^2}{n_4^2} \tag{1}$$

where, n_μ, $\mu = 1, 2, 3, 4$; $n_4 = n$; are experimentally measurable characteristics of the medium. In 1983 the universal symmetry of the overhead study was first conquered by R. M. Santilli and suggested that it can be written for the simpler case of motion in the (3,4)-plane as,

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

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

$$\hat{\gamma} = \frac{1}{\sqrt{1-\hat{\beta}^2}},\ \ \hat{\beta} = \beta\frac{n_4}{n_3} = \frac{\nu_3}{c}\frac{n_4}{n_3}. \tag{4}$$

The new isomathematics, physical formulations and correlated geometries for nonrelativistic and relativistic, classical and operator formulations for interior dynamical problems have currently experimental verifications in altogether quantitative sciences, including classical physics,particle physics, nuclear physics, super-conductivity, chemistry, biology, astrophysics and cosmology.

Remembering the Doppler law which is an ultimate manifestation of the Lorentz symmetry from which it can be uniquely derived, and predicts a null shift for null speed. But with the distinction, the covering isosymmetry exclusively characterizes a generalized law for the frequency of electromagnetic waves propagating within a physical medium, known as Doppler-Santilli isoshift law, which predicts the following frequency shift even for null speed.

$$\omega' = \frac{1-\beta\cos(\alpha)}{\sqrt{1\pm\hat{\beta}^2}}\omega \approx \left(1 - \frac{\nu_3}{c}\frac{n_4}{n_3} + ...\right)\omega = 1 \pm K(r,\nu,\omega,\delta,...), K > 0 \tag{5}$$

where the minus sign (-) is used for media of low density (such as air or water) and characterizes the isoredshift referred to a shift toward the red for light propagating within transparent physical media without any relative motion between the source, the medium and the observer; while the plus sign (+) is used for hyperdense media (such as those in the interior of stars, quasars and black holes) and characterizes the isoblueshift referred this time to an increase of the frequency without relative motion.

Thus Santilli's classification of Isoshifts is as follows

1. **IsoRedShift (IRS)**, occurs for the minus sign in Equation (5) when the medium is at a adequately low temperature when atoms are in their ground state, in such case light loses energy to the medium that produces significant anomalous redshift.

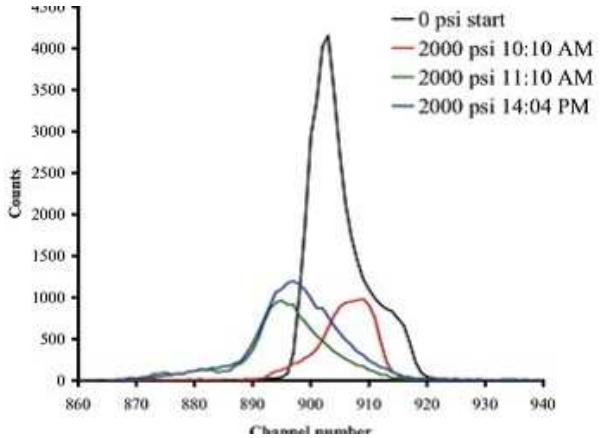

Figure 6: The first spectrogram obtained on June 12, 2011, showing the existence of Santilli IBS. In this picture, the large central peak represents the wavelength of the blue laser light at atmospheric pressure; the peak to the right represents the IRS at pressure; and the peak to the left represents the IBS also at pressure.

2. **IsoBlueShift (IBS)**,occurs for the plus sign in Equation (5) when the medium is at adequately high temperature when most of its atoms are in excited states,in such case light acquires energy from the medium by means of significant anomalous blueshift.)

3. **NoIsoShift** (NIS), occurs when the energy lost by light to the medium is equal to the energy released by the medium to light with no anomalous shift in which case $K = 0$ in Equation (5).

6 Concluding Remarks

Prof. R. M. Santilli conducted his mathematical,theoretical and experimental studies for interior dynamical problems and confirmed that light propagating within the physical media admits a IsoRedShift (IRS) and IsoBlueShift (IBS), without any relative motion between the source, the medium and the observer. His discoveries regarding (IRS) and (IBS) deal with excitation and de-excitation of atomic electrons, and independent from known molecular processes, such as scattering or absorption. For the isoredshift,the interactions between light and the medium cause a lose energy, thus a decrease of

the frequency, due to the impossibility that atoms in the medium lose energy since they are generally in their stable ground state. His discoveries regarding (IRS) and (IBS) deal with excitation and de-excitation of atomic electrons, and independent from known molecular processes, such as scattering or absorption and various measurements confirms the existence of Santillis hypothesis of anomalous redshift of light propagating within a gaseous medium at sufficiently low temperature without any relative motion between the source, the medium and the observer.

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