

# Santilli's IsoRedShift and IsoBlueShift. A Brief Review

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**Abstract.** This paper reports the theoretical, mathematical and physical foundation of hypothesis presented by R. M. Santilli regarding *IsoRedShift (IRS)* and *IsoBlueShift (IBS)*, we have concentrated on the compatibility of Santilli's IRS and IBS with the axioms of special relativity under their appropriate mathematical formulations. Present work describes the innovative experimental confirmations of IRS by Santilli in 2010 for a blue laser light in a tube containing air pressure up to 2,000 psi  $\approx$  1137 bars. The mathematical concepts and physics of IsoRedShift and IsoBlueShift as proposed by Santilli have been reviewed.

**Keywords:** IsoRedshift, Santilli's Blueshift.

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## INTRODUCTION

Generally, electromagnetic waves and particles propagate inside the anisotropic and inhomogeneous physical media. 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. Moreover, the literature survey reveals that Lorentz symmetry is not exactly applicable within a physical media and it needs consistent 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). However during the past fifty years, research conducted by large number of researchers, has identified mathematical, experimental, physical, chemical and industrial confirmation and as a result we now know that the Minkowskian geometry and special relativity are not precisely applicable [1] for interior dynamical problems (e.g., electromagnetic waves propagating within physical media and extended-deformable particles) [2]. By the 20<sup>th</sup> century propositions, these inadequacies were seemingly removed by means of the reduction of light to photons traveling in empty space and experiencing scattering, absorption and reemission by the atoms of the medium.

Santilli's studies have presented a remarkable revision of the special theory of relativity. By 1991 Santilli established the necessity to understand the light as electromagnetic waves propagating within a universal substratum. In 2012 Santilli achieved [3] the efficient measurements and established that while light traverses from Zenith to the Horizon, the entire spectrum of Sunlight experiences an *IRS* of about 100 nm. **With his mathematical, theoretical and to some extent his experimental evidences [4] he refuted the ideas like expansion of universe, the acceleration of the expansion, the expansion of space itself, dark matter, the big bang, and dark energy. The present review is an attempt to present Professor Santilli's view point on his IsoRedshift (IRS) and IsoBlueShift (IBS).**

### 1. Basic Physical and Theoretical Assumptions.

The previous astrophysical discoveries, such as those by E. Hubble [5], V. Slipher [6] presented the predictable law which 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. Immediately after above discovery, F. Zwicky [7] 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,  $C = c / n(x, \nu, \omega, \delta, \dots)$ , 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  $v$ , frequency  $\omega$ , density  $\delta$ , temperature  $T$ , etc. However Lorentz first attempted to establish the universal symmetry of local speeds  $C = c/n(x, v, \omega, \delta, T, \dots)$  and came across the major technical difficulties by considering the simpler case of constant speed  $c$  which sets aside the foundations of special relativity [3]. 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  $C = c/n(x, v, \omega, \delta, T, \dots)$ , which is today known as the *Lorentz-Poincare-Santilli (LPS) isosymmetry* and the isotopeis of this special relativity known as *Santilli isorelativity* [2].

A central prediction of special relativity is based on the 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. But this Doppler redshift is not applicable for the propagation of light within transparent physical medium. Santilli has carried out a step-by step isotopic lifting of the physical laws of special relativity resulting in a new theory i.e. *Santilli isorelativity*. Santilli's new measurements confirmed that, while traversing from the Zenith to the horizon, Sunlight experiences a shift of about 100 nm toward the red for the entire frequencies without any appreciable relative motion between the Sun, the atmosphere and the observer [8]. Therefore, light loses energy  $E = hv$  to cold media and experiences a decrease of its frequency  $\nu$ . This process takes place at atomic level and independent from molecular processes, such as scattering or absorption. **It is claimed that Santilli's IRS is similar to the cosmological redshift that has been described in ref. [9, 10]. Thus Santilli's Isorelativity attempts to scrutinize the current assumption of the expansion of universe and related aspects.**

## 2. Mathematical Background.

Santilli's fundamental idea is the representation of supposed interactions with a isotopic lifting to  $\hat{I}$  of the fundamental unit  $I$  of conventional theories, under the exclusive condition that  $\hat{I}$  is positive-definite, thus admitting the inverse  $\hat{I} = 1/\hat{T}$  and with the arbitrary functional dependence on local quantities, such as time  $t$ , coordinates  $r$ , velocities  $v$ , energy  $e$ , density  $d$ , frequency  $\omega$ , temperature  $T$ , and other variables

$$I \rightarrow \hat{I} = \hat{I}(t, r, v, e, d, \omega, \tau, \dots) = 1/\hat{T}(t, r, v, d, \omega, \tau, \dots) > 0.$$

(1)

Today the isotopically lifted unit is called *Santilli isounit*; its inverse  $\hat{T}$  is called the isotopic element, where  $\hat{T}$  remains fixed, under which  $\hat{I}$  indeed is to the right and left multiplying unit of the theory.

In 1983 Santilli [9] presented the isotopies of the Minkowski spacetime with his generalized symmetric (non-singular) spacetime given by,

$$x^2 = x_1^2 b_1^2 + x_2^2 b_2^2 + x_3^2 b_3^2 - t^2 c^2 b_4^2 = x_1^2/n_1^2 + x_2^2/n_2^2 + x_3^2/n_3^2 - t^2 c^2/n_4^2 \quad (2)$$

that today it is known as the *Minkowski-Santilli isospacetime*. In the above equation, the terms  $b_\mu = 1/n_\mu$  are the characteristic quantities considered for the medium; which are explicitly positive functions of all probable local variables, for example distance traveled by light  $d$ , temperature  $\tau$ , frequency of light  $\nu$ , density  $\rho$ , etc.,  $b_\mu = b_\mu(d, \rho, \tau, \nu, \dots) = 1/n_\mu = 1/n_\mu(d, \rho, \tau, \nu, \dots)$ ; they are normalized for the vacuum as  $b_\mu = 1/n_\mu = 1$ ,  $\mu = 1, 2, 3, 4$ ; the quantity  $1/b_4 = n_4$  is time characteristic and familiar to the index of refraction corresponding to speed of electromagnetic waves  $C = cb_4 = c/n_4$ ; the characteristics space quantities  $b_k = 1/n_k$ ,  $k = 1, 2, 3$ , stands for the anisotropy and inhomogeneity of the medium; and their values are set by physical verification. The new *Doppler-Santilli IsoShift* referred to a frequency shift partially due to relative motion between the source and the observer, and partially due to the medium in which the electromagnetic waves propagates and is given by

$$\omega \approx \omega_0 \left( 1 \pm \frac{v_s^2}{c^2} \frac{n_4^2}{n_s^2} + \dots \right), \quad (3)$$

The effect depends on the anisotropic and inhomogeneous character of the medium. Subsequently, Santilli has re-established the velocity of light as the local variable  $C = c/n$ . Next Santilli provided an evidence that, when the speed of light within a physical medium is no longer  $c$ , the universal *Lorentz-Poincare-Santilli isosymmetry (LPS)* for all possible local speeds  $C = c/n$  characterizes the Doppler-Santilli isoredshift [11]. Santilli evidently recognized the fact that the characteristic quantities  $n_\mu$  are velocity dependent. Therefore, isolaw (3) reveals an

exact case, in which a frequency shift occurs without any relative motion between the source, the medium and the observer,

$$\omega_e = \omega_0 (1 \pm Kd + \dots), \quad kd = \left[ \frac{v^2}{c^2} \frac{n_4^2}{n_3^2} \right]_{v=0} \neq 0 \quad (4)$$

where  $\omega_e$  ( $\omega_0$ ) is the frequency measured (at the origin) and  $d$  represents the distance traveled by light in the medium. **In the above Santilli's formulation the relative motion is null and this formulation is termed as Santilli IsoShift [12, 13].**

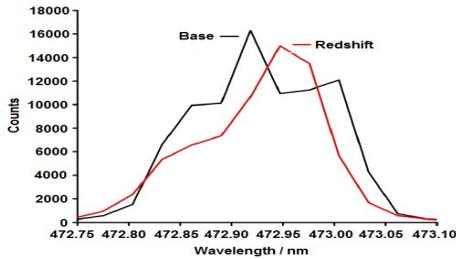
*Santilli IsoShift (IS)*, is a shift of the frequency of light when propagating within a physical medium without any relative motion between the source, the medium and the observer.

Thus Santilli's classification of IsoShift is as follows

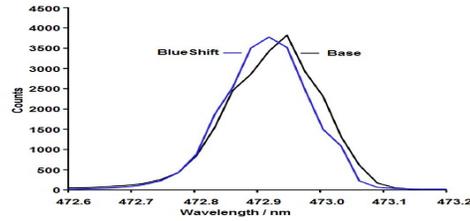
*IsoRedShift (IRS)*, occurs for the minus sign in (4) when the medium is at a adequately low temperature when atoms are in their ground state, in such case light loses energy  $E = hv$  to the medium that produces significant anomalous redshift.

*IsoBlueShift (IBS)*, occurs for the plus sign in (4) when the medium is at adequately high temperature when most of its atoms are in excited states, in such case light acquires energy  $E = hv$  from the medium by means of significant anomalous blueshift.

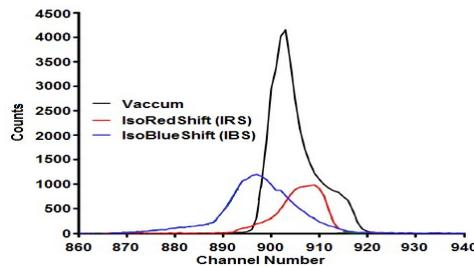
*NoIsoShift (NIS)*, occurs when the energy lost by light to the medium is equal to the energy released by the medium to light with no anomalous shift in which case  $K = 0$  in (4).



**FIGURE 1.** One of the systematic experimental confirmations obtained by G. West and G. Amato [14] on the existence of Santilli's IRS via the same IsoShift Testing Station used in Ref. [13], ( adapted from Fig. 6 of Ref.[10])



**FIGURE 2.** One of the systematic experimental confirmations obtained by G. West and G. Amato [13] on the existence of Santilli's IBS via the same IsoShift Testing Station used in Ref. [14],(adapted from Fig. 8 of Ref.[13])



**FIGURE 3.** The first of systematic experimental confirmations obtained by G. West and G. Amato [13] on the existence of Santilli's IBS via the same IsoShift Testing Station used in Ref. [14].The central peak indicates the blue laser light under vacuum; the peak to the right indicates IRS obtained at night; and the peak to the left presents the first measured IBS (adapted from Fig. 7 of Ref. [13]).

### 3. CONCLUSIONS

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. **According to Santilli the most significant cosmological inference is that it gives an opportunity to reconsider the status of the current proposal of the expansion of universe. Further investigations on its cosmological implications are in progress.**

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