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Comments on I. Gandzha's Paper: "Solar Redshift Calculation by the Rayleigh Scattering Mechanism"

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Abstract

In the recent paper [14], the Ukrainian physicist I. Gandzha has expressed the view that the Rayleigh scattering model on light *intensity* provides the basic representation of Santilli's IsoRedShift origin of the redshift of*frequencies* of direct Sun at Sunset [7-12]. In this paper we point out that such a view is unsubstantiated on various counts, such as: scattering cannot occur for light propagating along a straight line, thus preventing the use of any scattering model on the behavior of frequencies of direct Sunlight; the data on Santilli's IsoRedShift cannot be used to fit Rayleigh scattering since their accuracy is for frequencies, rather than on intensity; Santilli's IsoRedShift is centered in the physical origin of the redness of the Sun at Sunset as being due to loss of energy by light to air, while Rayleigh scattering provides no interpretation of said redness; and other reasons. However, it is pointed out that, following a due reformulation, Rayleigh scattering [15] should be applicable to the part of direct Sunlight lost to scattering, since that is the origin of the colors of our atmosphere. Thereafter, following experimental confirmations on intensities independently from Santilli's measurements of frequency shifts, Rayleigh or other scattering models on intensities are expected to be complementary to Santilli's IsoRedShift in the frequencies in the same way as Doppler's frequency shift and intensity (luminosity) models of far away galaxies are complementary to each other without conflict.

Key words: solar redness, Rayleigh scattering, Santilli IsoRedShift

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The Italian-American physicist R. M. Santilli has dedicated decades of mathematical, theoretical and experimental studies on the origin of the redness of Sunlight at the horizon by:

1) Identifying the appropriate mathematics for the correct geometric representation of the inhomogeneity and anisotropy of our atmosphere [1-3];

2) Showing that said correct geometric representation predicts Sunlight to lose energy to our atmosphere without any relative motion between the sun and the observer, an effect today called *Santilli IsoRedShift* (IRS) [3-6]; and

3) Conducting systematic experimental confirmations, firstly, on monochromatic laser light propagating within a pipe at pressure, and then via direct measurements of the frequency of Sunlight in the transition from the Zenith to the horizon [7-10].

The result of this research is that , *in the transition from the Zenith to the horizon (both for Sunset and Sunrise), the entire spectrum of Sunlight experiences an IRS of about* 100 *nm.* In particular, blue light completely disappears at the horizon and it is shifted to the red by about 100 *nm*, while red light is shifted also of about 100 *nm* toward the infrared according to lines that did not exist for the Sun at the Zenith.

The above result have received independent confirmations in Ref./ [11] for the IRS of monochromatic laser light, and in Ref. [12] for the IRS of the entire spectrum of sunlight (see also Ref. [13]). In particular, the numerical value of the frequency shift for monochromatic laser light in the pipe, when prorated to the trajectory of Sunlight in Earth's atmosphere, yields precisely about 100 *nm* as needed for Sunset and Sunrise . Consequently, Santilli's measurements of IRS for ,monochromatic laser light constitute, *per se,* an independent confirmation of the IRS of all frequencies of Sunlight at the horizon.

Subsequent to the appearance of this rather vast research, the Ukrainian physicist I. Gandzha released paper [14] according to which the redness of the Sun at Sunset is due to the Rayleigh scattering mechanism [15] essentially expressible via the following classical phenomenological approximation

$$I(\lambda) = I_0(\lambda) \exp(-\tau(\lambda)\, m(Z)) \approx N \frac{1}{\lambda^4}, \tag{1}$$

where: the quantity $\tau(\lambda)$ is called the characteristic optical depth of the atmosphere; $m(Z)$ is the optical path in air measured in relative air masses and proportional to the path traveled by light in the atmosphere; Z is the solar zenith angle (0 when the Sun is at the zenith and 90° when the Sun is at the horizon)' and N is approximately a constant.

While confirming the historical and physical value of Rayleigh scattering, this paper is intended to express the following comments on Gandzha's [14] interpretation of Santilli's IRS [1-12]:

A. On historical ground, Rayleigh [15] conceived and developed his scattering model for the colors of the *atmosphere* and *not* for the color of direct Sunlight, because he knew that the colors of our atmosphere are indeed due to scattering of light (in the absence of scattering, our sky would be black day and night), and that scattering cannot occur along a straight line by its very conception and technical realization. It should be noted in this respect the intense redness of the atmosphere at Sunset that fully confirms its scattering origin in support of Rayleigh and other models. Moreover, the redness of the atmosphere at Sunset is bigger than the redness of direct Sunlight also at Sunset, g thus being evidence of the occurrence in our atmosphere of inelastic scattering causing indeed a redshift, but again, solely for the "scattering" of light defined according to the Webster Dictionary as the disorderly dispersal of light in all directions and positively not for Sunlight propagating along a straight line.

B. In the propagation of Sunlight in our atmosphere, part of Sunlight is indeed lost due to scattering, but the remaining part does reach us. Since the main mechanist of Eq. (1) is scattering, when dealing with direct Sunlight, Rayleigh model should be applied to the intensity of Sunlight lost to scattering and cannot be consistently applied to the remaining part of direct Sunlight reaching us, again, because of the absence of scattering in the latter case.

C. According to its original conception [15], Rayleigh scattering is solely a *phenomenological* description of the intensity of light with no hint whatsoever for the physical origin of its variation depending on the position of the Sun, while Santilli's IRS is primarily intended to provide the physical origin of the redness of the Sun at Sunset, namely, the loss of energy by all frequencies of light to air.

D. Rayleigh scattering provides a phenomenological representation of the *intensity* of light, while Santilli's IRS deals with *frequencies* as clearly illus-

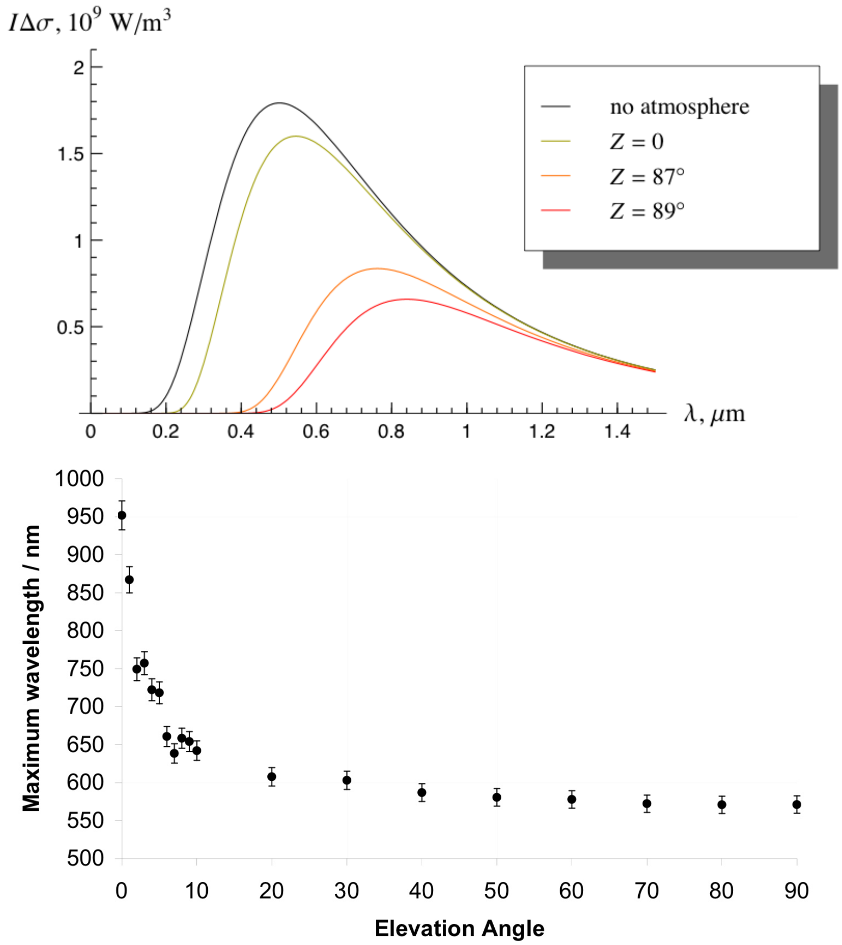

Figure 1: Copy of the main figure of Ref. [14] in the top, clearly illustrating its referral to *intensities,* and a representative figure of Ref. [12] at the bottom, clearly illustrating its referral to *frequencies* (or wavelengths).

trated by the differences of the two diagrams of Fig. 1. Consequently, under proper reformulation, the formulation of Rayleigh scattering presented in Ref. [14] is expected to be a rather natural complement of Santilli's IRS with no identifiable conflict. This is established by the fact that the Minkowski-Santilli IsoGeometry 4] recovers uniquely and identically the Minkowskian geometry when light propagates in vacuum, thus recovering the complementarity of the Doppler's law and the intensity (luminosity) established in astrophysics following about one century of measurements. Accepting this duality in astrophysics, but denying it for our atmosphere, would be non-scientific because it would imply a double standard for physical laws that are known to be universal.

E. Contrary to Gandzha view [14], Santilli's measurements of IRS *cannot* be consistently applied to the Rayleigh scattering because, as clearly stated in Refs. [7-12], the telescope used in all measurements of Sunlight from the Zenith to the horizon was manually adjusted toward the Sun, thus leading to evident variations of the intensity depending on the orientation of the telescope. However, it is equally stress that all analyzers were set for accurate detections of *wavelengths (frequencies)* under an intensity sufficient to have accurate wavelengths detections (see the confirmation in scan analyses of Ref. [13]).

Therefore, according to a consensus by colleagues in the field contacted b y the author, Gandzha [14] view in assuming Rayleigh scattering as the physical origin of the redness of the Sun at Sunset is conceptually, theoretically and experimentally unsubstantiated because:

1) Rayleigh "scattering" was conceived and developed for the colors of our *atmosphere,* where scattering is indeed dominant, and definitely not for visible direct Sunlight;

2) No scattering can be consistently introduced in the propagation of Sunlight along of light along a straight line, no quantitative treatment of this central assumption of Ref. [14] is on record at this time to our knowledge and, in the event it exists, it can be dismissed on numerous grounds [12];

3) Assuming that scattering might somehow be admitted for direct Sunlight following structural modifications of Rayleigh original conception, by remembering that blue and red are shifted for about 100 nm at the horizon, scattering cannot possibly cause a redshift of blue light into redlight of of the order of 100 nm as needed to represent the redness at Sunset;

4) Rayleigh scattering is a purely phenomenological model and, therefore, provides no clue whatsoever on the physical origin of said redness, thus preventing any consistent use as the dominant even t for the redness of the Sun at Sunset while, by comparison, said physical origin is indeed the main aim of Santilli IRS for which reason it can be assumed as fundamental; and

5) Rayleigh scattering has no experimental verification at this writing since no experimental verification is on record to our knowledge for the colors of or atmosphere, and the wavelength analyzers used by Santilli for the IRS scans are accurate for the measurement of frequencies under varying intensities, e.g., irrespective of whether from a spec of Sunlight or from highly intense Sunlight at the Zenith, thus preventing Santilli's IRS measurements from being consistently used for intensity based models (see as done by Gandzha for the plot in the top of Figure 1 also Section 9 of Ref. [12]).

Additionally, we have to recall the corresponding situation in astrophysics where there is a complementary between the Doppler frequency shift law and the intensity (luminosity) description of light from fart away galaxies. It is evident that the same complementary is expected for the behavior of Sunlight in our atmosphere in order to avoid double standards, thus mandating the use of Santilli's IRS as the fundamental physical description, and the use of intensity models as a complement.

In any case, Santilli's IRS recovers identically Doppler';s law in vacuum for the cosmological redshift and related intensity (luminosity) data. Therefore, solely accepting Rayleigh scattering for Sunlight in pour atmosphere would be in contradiction with about one century of astrophysical knowledge.

In summary, also according to a consensus among the colleagues consulted by the author, Gandzha presentation of Rayleigh or other forms of scattering [14] should be reformulated for sound physical conditions (e.g., for the loss of intensity of Sunlight due to scattering, rather than for the intensity of direct Sunlight where no scattering can coninsistently be admitted) and, additionally, should be experimentally verified via tests independent from those on frequencies and via the use of detectors measuring the *intensity of light from our atmosphere,* ratehr than the *wavelength of direct Sunlight.* Following such a reformulation and experimental verification, Rayleigh or other scattering models can indeed be complementary to

Santilli's IRS without any conflict.

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