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Reconciliation of the Discrepancies in the Speed of Light: A 3D Study on the Intensity of Solar Energy

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Abstract:
Albert Einstein's Special Theory of Relativity postulates that the speed of Light is the upper limit - beyond which nothing can travel, so that, the essential relation between cause and effect will be maintained. Contrary to this irrefutable physical law, controversies about the speed of Light exist among the scientists; the final solution for this most discussed topic in the Physical Sciences is yet under debate. The present Speed of Light (299,792 km/sec) was determined in the year 1983 based on the measurement of a Laser beam, and accordingly, it is thought that Light from the Sun takes about 8.3 minutes to reach our Planet Earth. There are much dissimilarity between a Laser beam and the Sunlight. Laser Light originates from a two-dimensional flat surface of a narrow cylindrical tube and travels in the form of a beam - retaining the same Intensity, whereas Sunlight emanates from the three-dimensional spherical surface of the Sun; obviously, the Light emanated from the spherical Sun will not travel in the form of a beam, but only expand away from all around the spherical surface of the Sun - concurrently decreasing the Intensity. As the distance of a receptor increase, the Intensity of Sunlight obtained by the receptor decreases accordingly. We can measure the Intensity of Sunlight as "per unit area", but it is not possible with a Laser beam; this is because Laser is a mono-chromatic Light, while the Sunlight is poly-chromatic. This shows that the speed of Sunlight cannot be decided by measuring the speed of a Laser beam. Therefore, we need to find out the "actual process" with which the Sunlight makes contact with the Solar Planets, so as to reconcile the existing discrepancies on the speed of Light.

Keywords: *Energetic particles of light, enlarged sphere, expansion of sunlight, intensity of sunlight*

1. Introduction

The Sun converts its Mass into Energy at the rate of about four million metric tons per second (Ref. The Physical Universe: An Introduction to Astronomy. University Science Books. p. 102), thereby emitting Energetic Particles of Light (Ref. Guide to the Sun, Cambridge University Press. pp. 47-532) from all around its three-dimensional spherical surface with an Intensity of 63,088,617 watts per square meter (Wm^{-2}) (Ref. Solar Radiation, Published online by The Encyclopedia of Earth) as shown in Figure 1 below:

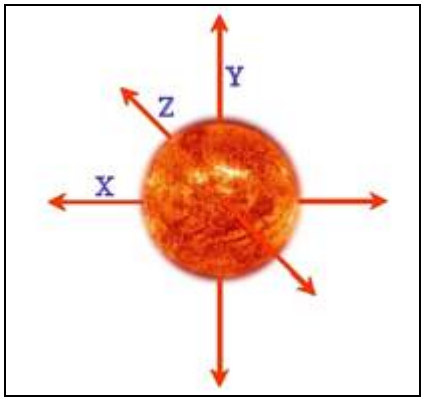

Figure 1: The Sun emits Energetic Particles of Light into space from all round its spherical surface with an Intensity of 63,088,617 Wm^{-2}

The Energetic Particles of Light thus emanated with enormous Intensity, expands - concurrently decreasing the Intensity, and makes contact with the Solar Planets as Sunlight with respective Intensities - in accordance with the Planets' Orbital Distances. Therefore, we shall analyze the Physical Characteristics of the Sun and the Orbital Distance of the Planets in a "Three-Dimensional" Perspective, and ascertain the "modus operandi" behind this phenomenon.

2. Three-Dimensional Analysis on the Sun's Physical Characteristics and the Planets Orbital Distances

2.1. The mode of Sunlight's contact with our Planet Earth at its Mean Orbital Distance

The Sun is a near perfect sphere (Ref. How Round is the Sun?. NASA), and its surface area is 6,090,000,000,000 km^2 (Ref. Solar System Exploration: Planets: Sun: Facts & Figures, NASA). To make contact with our Planet Earth at its Mean Orbital Distance i.e. 149,600,000 km (Ref. Earth Fact Sheet, NASA), the Light emanated from the spherical surface of the Sun extends in all directions - concurrently decreasing the Intensity, and makes contact with Earth in the form of an "Enlarged Sphere"; the radius (r) of this Enlarged Sphere will be the distance from centre of the Sun to the Mean Orbital Distance of Earth. (Please refer Figure 2 below.)

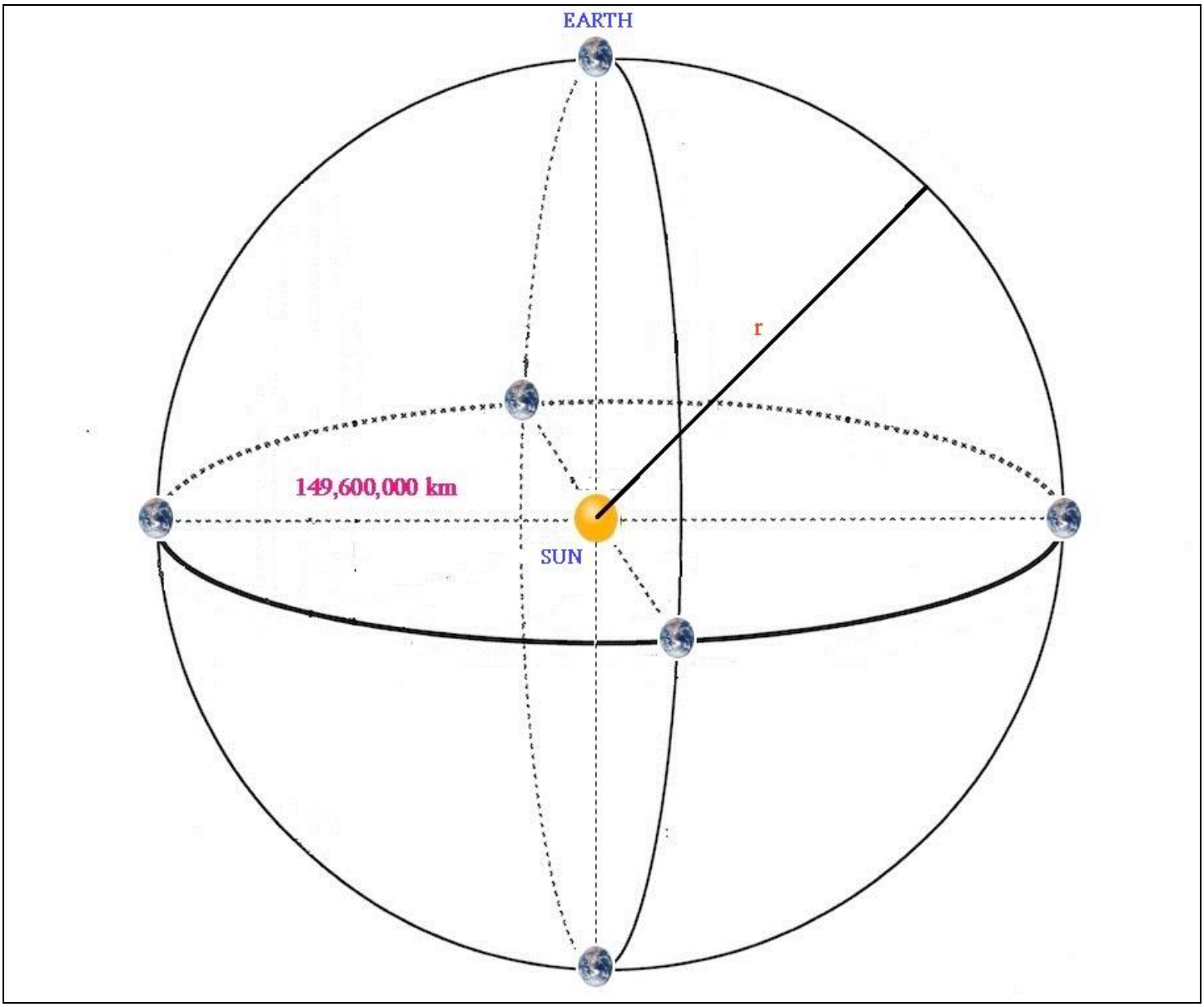

Figure 2: shows Sun at the center - encircled with the Enlarged Sphere formed by the Sunlight at the Mean Orbit of Earth; Planet Earth positioned in any point on the surface of this Enlarged Sphere, will get the Sunlight with the same Intensity - in all the positions.

2.2. Intensity of Sunlight Obtained by the Planet Earth at its Mean Orbital Distance

To get the Intensity of Sunlight obtained by the Planet Earth we have to pass through the three steps of computation i.e., Step 1: Calculate the Surface Area of the Enlarged Sphere formed by the Sunlight at the Earth's Mean Orbital Distance, Step 2: Find out the Amount of Expansion of Sunlight, and finally Step 3: Determine the Intensity of Sunlight obtained by the Planet - at the top of its atmosphere.

Step 1: Surface Area of the Enlarged Sphere formed by the Sunlight

Formula for the Surface Area of a Sphere is $4\pi r^2$; then, Surface Area of the Enlarged Sphere will be:

4π (Mean Orbital Distance of Earth)^2 = (4 x 3.14) x (149,600,000 km)^2

= (12.56) x (22,380,160,000,000,000 km^2) = 281,094,809,600,000,000 km^2 (1)

Therefore, Surface Area of the Enlarged Sphere is: 281,094,809,600,000,000 km^2

(Please refer Figure 3 below.)

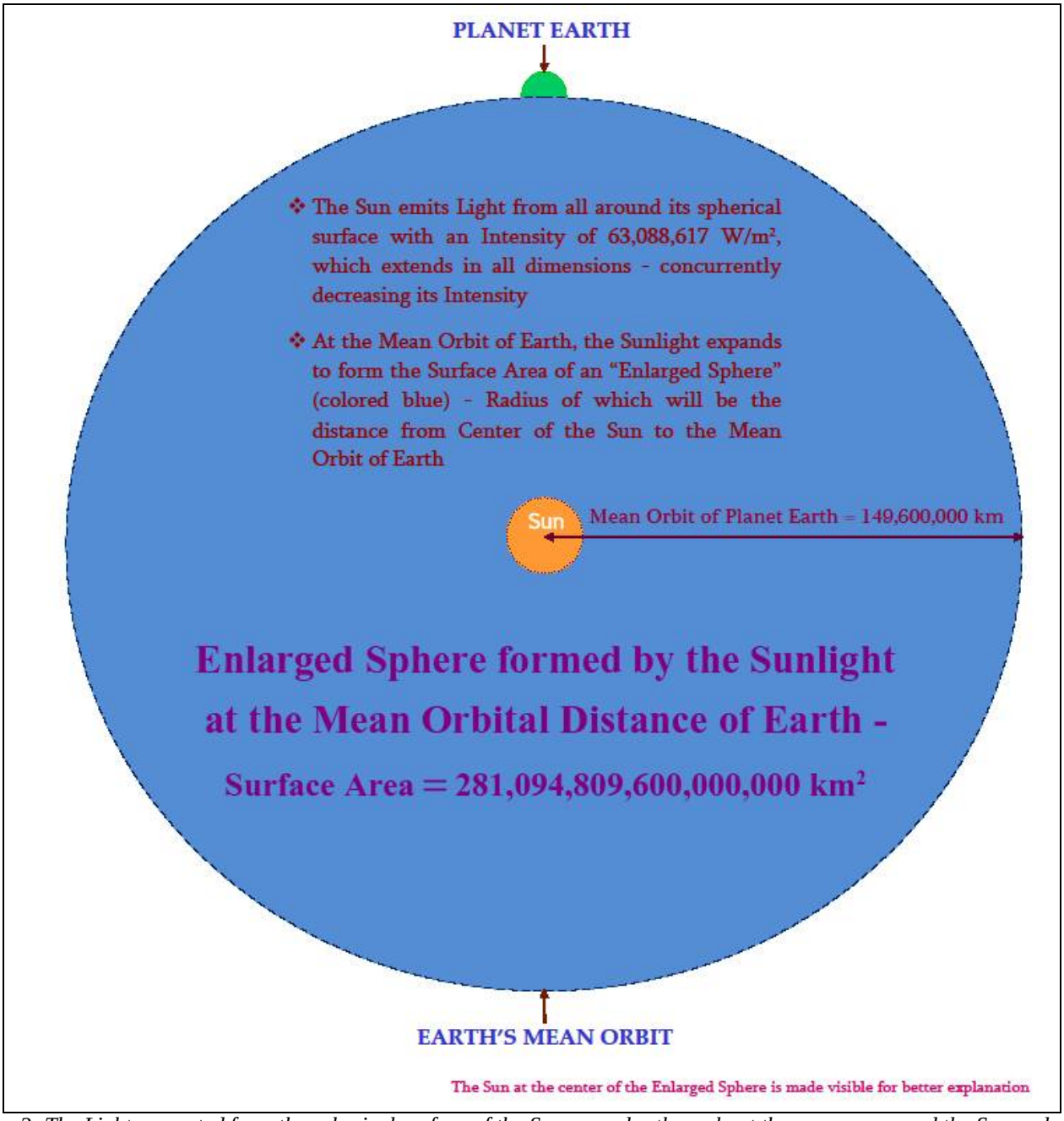

Figure 3: The Light emanated from the spherical surface of the Sun pervades throughout the expanse around the Sun and makes contact with the Planet in the form of an Enlarged Sphere.

Step 2: The Amount of Expansion of Sunlight

The Amount of Expansion of the Sunlight at the Mean Orbit of Earth will be:

$$\frac{\text{Surface Area of the Imaginary Sphere}}{\text{Surface Area of the Sun}} \quad \frac{281{,}094{,}809{,}600{,}000{,}000 \text{ km}^2}{6{,}090{,}000{,}000{,}000 \text{ km}^2} = 46{,}157 \tag{2}$$

Thus, the Amount of Expansion of the Sunlight at the Earth's Mean Orbit is: 46,157 Times

Step 3: Intensity of Sunlight at the top of atmosphere of Planet Earth

The Intensity of Sunlight obtained by the Planet Earth - outside its atmosphere, will be:

$$\frac{\text{Intensity of Sunlight at its Source}}{\text{Amount of Expansion of Sunlight}} = \frac{63{,}088{,}617 \text{ Wm}^{-2}}{46{,}157 \text{ Times}} = 1{,}367 \text{ Wm}^{-2} \tag{3}$$

Therefore, the Average Intensity of Sunlight at top of the atmosphere of Earth is: 1,367 Wm^{-2}

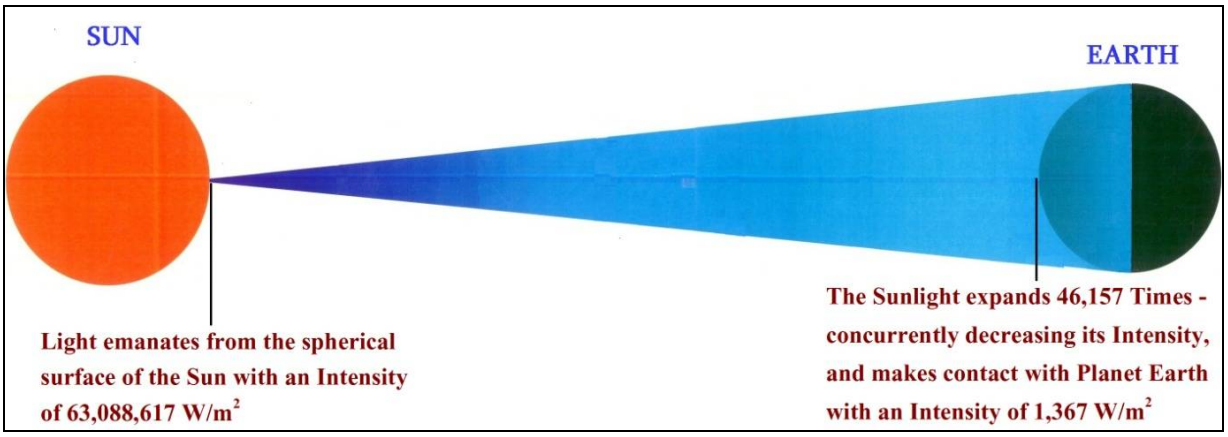

Figure 4

The above analysis shows that the Light emanated from the spherical surface of the Sun with an Intensity of 63,088,617 Wm^{-2}, expands 46,157 Times - concurrently decreasing the Intensity, and makes contact with the Planet in the form of an Expanded Sphere; so that, Planet Earth gets the Sunlight with an Intensity of 1,367 Wm^{-2}.

The Intensity of Sunlight obtained by Earth at its mean orbit as per the Theoretical Calculations - based on the Expansion of Sunlight and its concurrent decrease of Intensity, precisely agrees with the practical data collected by way of space probes (Ref. Introduction to Solar Radiation by Newport Corporation) - as depicted in the Appendix. It is obvious that the Amount of Expansion of Sunlight at the Earth's Mean Orbit (46,157 Times) and the Intensity of Sunlight obtained by the Earth (1,367 Wm^{-2}) are perfectly synchronized; thus, the Intensity of Sunlight is Inversely Proportional to its Expansion.

Therefore, we can determine the Intensity of Sunlight obtained by all the Solar Planets - using the formula shown below:

$$\text{Intensity of Sunlight Obtained by the Planet underway} = \frac{\text{Intensity of Sunlight at its Source}}{\text{Amount of Expansion of Sunlight}}$$

2.3. The Intensity of Sunlight obtained by the Planets Mercury and Jupiter at their Perihelion and Aphelion positions - using the Theoretical Formula, are shown below for examples; Distances of the Perihelion and Aphelion Position of the Planets were derived from the NASA Planetary Comparison Chart

2.3.1. Intensity of Sunlight obtained by Planet Mercury at its Perihelion and Aphelion Positions

a) Distance of Planet Mercury's Perihelion Position = 46,001,009 km

$$\text{Intensity of Sunlight at Mercury's Perihelion Position} = \frac{\text{Intensity of Sunlight at its Source}}{\text{Amount of Expansion of Sunlight}}$$

$$\frac{63{,}088{,}617 \text{ Wm}^{-2}}{4{,}364 \text{ Times}} = 14{,}456 \text{ Wm}^{-2} \tag{4}$$

Intensity of Sunlight at Mercury's Perihelion Position = 14,456 Wm^{-2}

b) Distance of Planet Mercury's Aphelion Position = 69,817,445 km

$$\text{Intensity of Sunlight at Mercury's Aphelion Position} = \frac{\text{Intensity of Sunlight at its Source}}{\text{Amount of Expansion of Sunlight}}$$

$$\frac{63{,}088{,}617\ \text{Wm}^{-2}}{10{,}053\ \text{Times}} = 6{,}275\ \text{Wm}^{-2} \quad (5)$$

Intensity of Sunlight at Mercury's Aphelion Position = 6,275 Wm^{-2}

2.3.2. Intensity of Sunlight obtained by Planet Jupiter at its Perihelion and Aphelion Positions

a) Distance of Planet Jupiter's Perihelion position = 740,679,835 km

$$\text{Intensity of Sunlight at Jupiter's Perihelion position} = \frac{\text{Intensity of Sunlight at its Source}}{\text{Amount of Expansion of Sunlight}}$$

$$\frac{63{,}088{,}617\ \text{Wm}^{-2}}{1{,}131{,}445\ \text{Times}} = 55.76\ \text{Wm}^{-2} \quad (6)$$

Intensity of Sunlight at Jupiter's Perihelion position = 55.76 Wm^{-2}

b) Distance of Planet Jupiter's Aphelion Position = 816,001,807 km

$$\text{Intensity of Sunlight at Jupiter's Aphelion Position} = \frac{\text{Intensity of Sunlight at its Source}}{\text{Amount of Expansion of Sunlight}}$$

$$\frac{63{,}088{,}617\ \text{Wm}^{-2}}{1{,}373{,}266\ \text{Times}} = 45.94\ \text{Wm}^{-2} \quad (7)$$

Intensity of Sunlight at Jupiter's Aphelion Position = 45.94 Wm^{-2}

We can also find out the Intensity of Sunlight obtained by the other Planets - at their Perihelion and Aphelion Positions, using the same Formula.

3. Verifying the Theoretical Results on the Intensity of Sunlight

Intensity of Sunlight obtained by the Solar Planets at their Perihelion and Aphelion positions - as measured by the Space Probes (Ref. Sunlight, Intensity in the Solar System by Wikipedia) (colored "rose"), and the Intensity of Sunlight obtained by the Planets - as per the Theoretical Formula at the corresponding positions (colored "blue"), are furnished in the comparison **Table** below

Sl. No.	Planet	Closest Distance from Sun - Perihelion Position (AU)*	Intensity of Sunlight as per the Satellites' Data (Wm^{-2})	Intensity of Sunlight as per the Theoretical Formula (Wm^{-2})	Farthest Distance from Sun - Aphelion Position (AU)*	Intensity of Sunlight as per the Satellites' Data (Wm^{-2})	Intensity of Sunlight as per the Theoretical Formula (Wm^{-2})
1.	Mercury	0.3075	14,446.00	14,456.00	0.4667	6,272.00	6,275.00
2.	Venus	0.7184	2,647.00	2,648.00	0.7282	2,576.00	2,577.00
3.	Earth	0.9833	1,413.00	1,414.00	1.0170	1,321.00	1,322.00
4.	Mars	1.3820	715.00	716.00	1.6660	492.00	492.00
5.	Jupiter	4.9500	55.80	55.76	5.4580	45.90	45.94
6.	Saturn	9.0480	16.70	16.79	10.1200	13.40	13.53
7.	Uranus	18.3800	4.04	4.09	20.0800	3.39	3.38
8.	Neptune	29.7700	1.54	1.54	30.4400	1.47	1.48

Table 1

**AU (Astronomical Unit) = 149,597,871 km*

The statistics in the table show that, the Intensities of Sunlight obtained by the Planets - as per the Amount of its Expansion, accurately coincides with the Practical Data collected through the Space Probes; the Intensity of Sunlight is perfectly in tandem with the Amount

of its Expansion. It is evident that, as the Planets Orbital Distance increase - the Amount of the Expansion of Sunlight also increases, and the Intensity of Sunlight gets decreased by exactly the same Amount of its Expansion.

4. Conclusions

The Energetic Particles of Light emanated from the spherical surface of the Sun with immense Intensity, extends in all directions - concurrently decreasing its Intensity, so as to make contact with the Solar Planets in the form of an Enlarged Sphere; when the Planet underway is positioned in any point on the surface of this Enlarged Sphere i.e., when it is located in any direction of the Sun - at the same distance, the Planet will get the Sunlight with the same Intensity - in all the positions. Because the Light emanated from the Sun pervades throughout all the space around the Sun - leaving no room for any external medium and as the Amount of Expansion of Sunlight is perfectly in tandem with its Intensity, there is no time delay in this phenomenon. Light of all the celestial sources (three-dimensional objects) also follow the same fashion.

5. Appendix

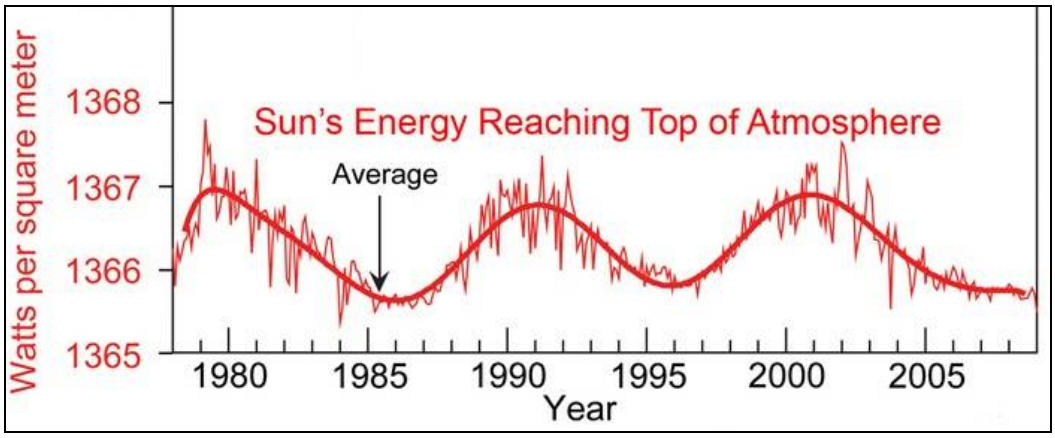

Figure 5: The average Intensity of Sunlight outside the Earth's atmosphere during the period from 1980 to 2005 - as measured by the satellites - is shown in the figure above.

6. Acknowledgement

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