A few implications of the laws of transactions, From the Abstraction Theory.

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ABSTRACT:

Considering transport of light through space-time, following the laws of physical transactions (**viXra:1101.0035**) it may be said that there must be a spreading effect on it. Over suitable distances from a source of light, an observer's perception is bound to be affected due to this spreading. In the following paper, these effects on the reception of a signal, due to the spreading of light are studied. Experimental set-ups are desired to verify the actual angles of spread with their theoretical values. An experiment regarding the minimum distance between two disturbances for them to be distinguishable is also carried out. The energy quantum is also studied in a new light.

INTRODUCTION:

In accordance with the laws of physical transactions stated in my paper (**viXra:1101.0035**)a light signal emanating from a given source will spread as such reception of the signal at a suitable distance away from the source will be affected. An observer's perception of a given source is thus bound to be distorted from the original, if the source is at considerably large distance away (example: reception of light from other galaxies). Over smaller distances between the source and the observer, though, the effects of the spread of the light-signal may not be considerable however, being of negligibly small dimensions.

As an experimental set-up on an inter-galactic scale may not yet be possible, in order to examine the spread of light, we must have to devise such a set-up which is possible and practical. This paper also deals with such an experimental set-up, with which it is possible to verify the spread of different wavelengths of light. Theoretical values are tallied against the experimental ones. Further the minimum distance of separation required for two waves to be distinguishable is studied through another experiment. Lastly, the energy-quantum is studied in accordance with the laws of physical transactions, with regards to the theory of abstraction.

DIFFERENT RATES OF SPREAD FOR DIFFERENT FREQUENCIES:

Notwithstanding the effect of spreading of photon-gas, the photons themselves must tend to expand according to my last paper 'Transport theory-Laws of physical transaction'. Light with different wavelength must have a proportional rate of spreading.

Let figure-1 represent a simple projectile motion under acceleration (α).

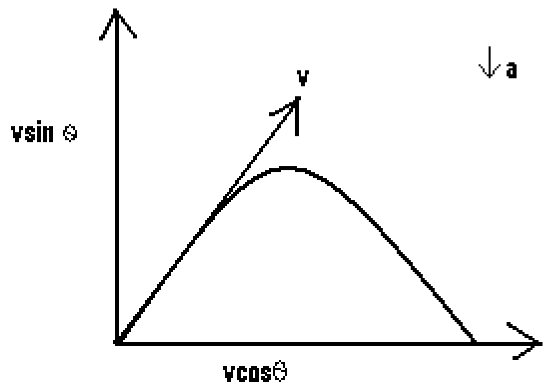

Fig 1 : Simple projectile (half the wave)

The range, $R = (v^2 \sin 2\theta)/a$ i.e, $a = (v^2 \sin 2\theta)/R$ ……(1)

Time of flight, $t = (2v \sin\theta)/a$ i.e, $a = (2v \sin\theta)/t$ ……(2)

The spreading of a single photon may be considered to be a wave of itself, which in turn may be considered to be a combination of two such projectile motions with a pseudo acceleration (α), as shown in fig-2

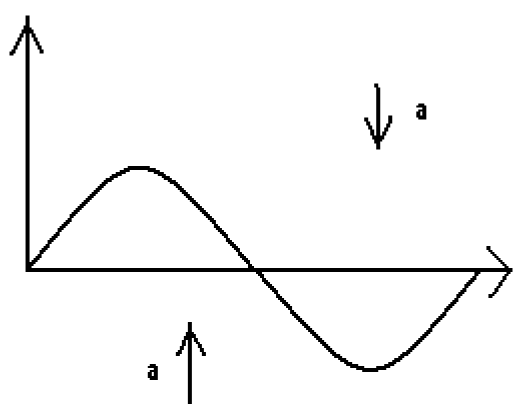

Fig 2: Wave motion as a combination of two projectile motions.

Again, the time of flight (t) of each projectile motion must be half the time-period (T) concerned radiation such that, $t= T/2$.Similarly, the range ® of each projectile motion may be considered to be half the wavelength (λ) of the radiation, such that, $R= \lambda/2$.

Dividing equation (1) by equation (2) and placing T=t/2 R= λ/2 and v=c (speed of light in vacuum) we get,

$$\cos\theta = \lambda/Tc$$

Considering light with a difference in wavelength (Δλ), over a distance x, for the difference in their angles of spreading (Δθ) we may write:

$$\cos\theta = x/\Delta Tc$$

i.e, $$\cos\Delta\theta = \Delta\lambda/x \qquad \ldots\ldots(3)$$

In order to test equation (3) we may send out lights of two given wavelengths (λ_1) and (λ_2) and then measure the angle (Δθ) at which we get light of a different wavelength due to the mixing up of the two different wavelength, for various distances (x).

The above experiment may be performed with two coherent sources of red and green lights in vacuum. The minimum distance at which yellow light is formed is to be measured. The experimental set-up is shown in figure 3.

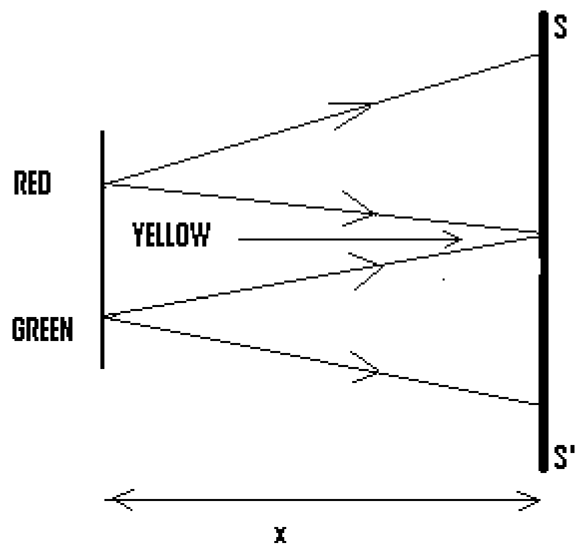

Fig 3: Experimental set-up for measurement of x

As the red and green lights spread they form yellow light at a distance x on a screen SS^1. The sources being placed reasonably close to each other, x may be made to be comfortably small. Photographic plates are used for precise measurements.

Using equation (3) we may write:-

$$X = \Delta\lambda / \cos\Delta\theta$$

COLOUR	WAVELENGTH (in nano-meters)	DIFFERENCE IN WAVELENGTHS ($\Delta\lambda$) (in meters)	ANGLE AT WHICH YELLOW LIGHT IS FORMED ($\Delta\theta$)	DISTANCE (x) (in meters)
RED	680		$\cos^{-1}26.67\times10^{-9}$	6
GREEN	520	160×10^{-9}	$\cos^{-1}22.86\times10^{-9}$	7
YELLOW	560		$\cos^{-1}40\times10^{-9}$	4

Table 1-Measurement of the distance and the angle of formation of yellow-light.

For light frequency (ν) using similar treatment as earlier (reference fig. 1 and fig. 2), we can write,

$$a=2c\,\nu\sin2\,\theta \qquad \text{……(4)}$$

and

$$a=4A/c\sin^2\theta \qquad \text{……(5)}$$

A being the ‘amplitude’ of the concerned disturbance.

Now, θ being reasonably small, we can consider from fig.1, the following figure,

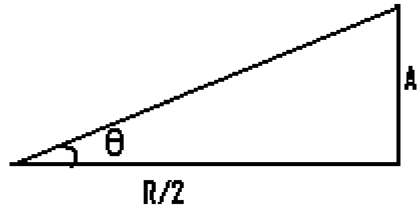

Fig.4 Estimation of the disturbance due to spread of photon.

$$A=\lambda\tan\theta/4$$

$$=c\tan\theta/4\nu \qquad \text{……(6)}$$

From equation (5) and (6) we get,

$$A=4A/\ c\sin^2\theta$$

$$=1/\ v\sin\theta\cos\theta \qquad \text{.......(7)}$$

Finally, from equations (4) and (7) we have,

$$2cv\sin 2\theta=1/v\sin\theta\cos\theta$$

i.e., $$\theta=(1/2)\sin^{-1}(1/v\sqrt{c}) \qquad \text{.....(8)}$$

<u>Minimum separation for two waves to be distinguishable:</u>

From previous arguments it is obvious that there must be a certain minimum distance between two given disturbances, so that they are distinguishable. This minimum lateral distance (Δƀ) between the waves so that they can retain their individuality would depend on the difference in wavelengths (Δλ) for the two given waves.

In fact, (Δƀ) ∝ (Δλ)

Or, (Δƀ)=ł(Δλ) ......(9)

where ł is a constant of proportionality for the concerned system.

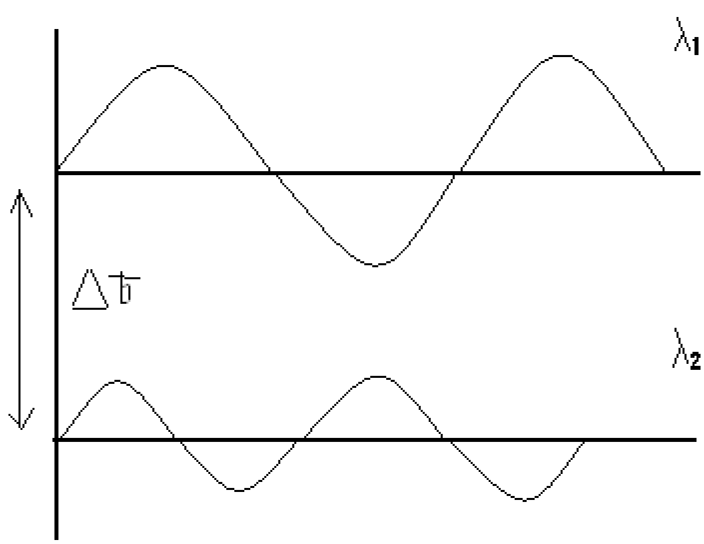

Fig 5: Two waves of wavelengths λ_1 and λ_2 at a lateral distance Δƀ from each other. Δƀ is the minimum distance between the waves so that they are distinguishable.

We carry out an experiment to estimate the value of the constant ł. The experimental set-up, as shown in fig-6, is used to pass a current through a cylindrical conductor M, through which electrons ()due to skin effect) flow only along the surface. As such, an electric-current is obtained only along the surface of the conductor M. this conductor is again connected to a board T, in which conductors are layered one after another. The conductors in T and M are connected to electric bulbs. Inside M, an arrangement is made in such a way that a filament F sets out beams of photons of particular wavelengths. For various wavelengths we get current through various conductors, which can be seen from the glowing of various bulbs.

The photons, emanating from the filament with certain particular wavelengths force the electrons flowing along the skin of the cylindrical conductor M further away from it. We measure the wavelength of light (λ_L) for which the electrons move through a conductor, further away from the skin at a distance (say λƀ) from the filament.

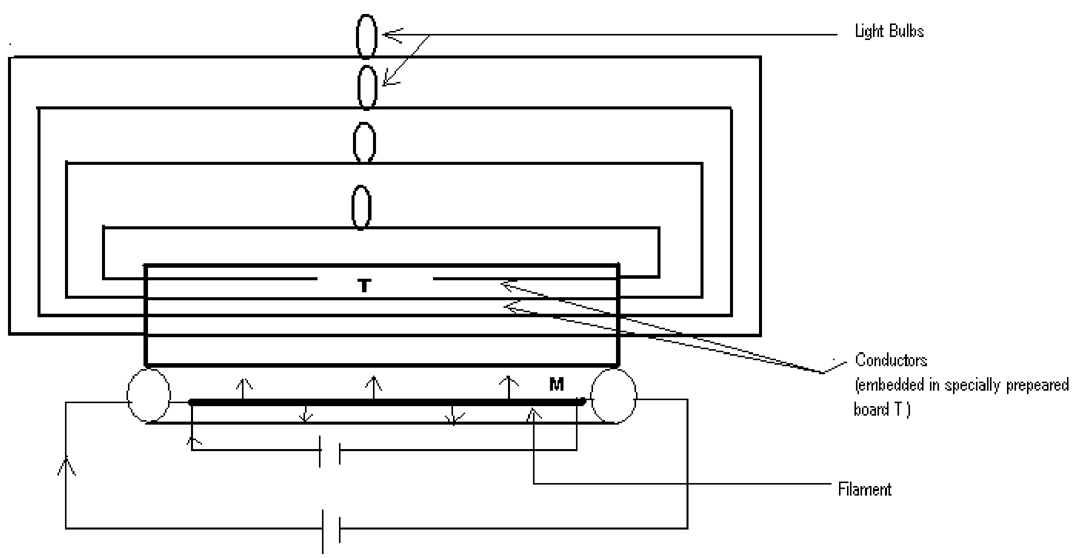

Fig 6: Apparatus used to find the value of ł.

The electrons have a kinetic energy=120eV,

Therefore, momentum of electron,

$p=\sqrt{(2mK)}$

$= \sqrt{\{2(9.11\times10^{-31})(120)(1.6\times10^{-19})\}}$ (the rest mass of electron $m=9.11\times10^{-31}$kg)

$=5.91\times10^{-24}$kg m/s

Thus, de Broglie wavelength of electron,

$$\lambda=h/p$$

$$=6.63\times10^{-34}/5.91\times10^{-24} \text{ kg m/s}$$

$$=112 \text{ pm}$$

Wavelength of light used, λ_L=560nm

The difference between wavelength of the light used and the electrons,

$$\Delta\lambda = \lambda_L-\lambda_e$$

$$=560 \text{ nm} - 112 \text{ pm}$$

$$=559.888\text{nm} = 559.888\times1^{-9}\text{m}$$

The bulb that glows is due to the conductor at a distance (from the filament),

$$\Delta ƀ = 3.6\times10^{-4}\text{m}$$

Therefore, the value of

$$Ł = \Delta ƀ/\Delta\lambda = 3.6\times10^{-4}/559.888\times10^{-9}$$

Ie., $ł = 0.00642986\times10^{5}$

This experiment is repeated several times such that current is drawn through several other conductors embedded in the board T, such that the respective bulbs glow. In each case, Δƀ

and Δ√ are noted and the value of ł is calculated, which comes to quite the same in each case.

INSIDE THE ENERGY QUANTUM:

In the lines of the treatment used in my paper on the Theory of Abstraction, (**viXra:1101.0035**), on introduction of an energy quantum related to a space-time configuration [s' = $(cT')^{4i}$] in a region with configuration [s = $(cT)^{4i}$], we may write,

$$2\nu = c^{4i}(\Delta T)^{4i} \quad \text{....(10);}$$

Where, ν is the frequency of the disturbance, h is Plank's constant and ΔT = T' – T.

Due to the introduction of energy quantum, the vicinity gets 'stretched' from time T to T'. This stretching yields a cone as in spectrum with a radius (say, r), height (ΔT) and slant-height (say, l). The volume of this cone,

$$V = 1/3 \prod r^2(\Delta T)$$

The increase in surface of the space-membrane,

$$\Delta \acute{S} = \prod r(l-r)$$

Thus, the ratio of the increase in the surface of the space-membrane to the 'volume' of the energy introduced,

$$n = \{\prod r(l-r)\}/[\{(1/3)\prod r^2\}(\Delta T)]$$

$$\text{Ie.} \quad n = \{3(l-r)\}/r\Delta T$$

Placing $l = \sqrt{(r^2 + \Delta T^2)}$ in the above equation we get,

$$n = [3\{\sqrt{(r^2 + \Delta T^2)} - r\}]/r\Delta T \quad \text{.....(11)}$$

Now examining the transport of the disturbed space-time configuration to tend to take place equally in all directions as regards the laws of physical transactions, we may consider similar cones fill up all directions of space-time. Thereby, we can say that the included angle of each such cone equals 60^0

Thus for such a cone,

$$r = \Delta T \tan 30^0$$

$$= \Delta T/\sqrt{3}$$

Placing this value of r in equation (11), we have,

$$n = \frac{3[\sqrt{\{(\Delta t^2/3) + \Delta T^2\}} - \Delta T/\sqrt{3}]}{\Delta T/\sqrt{3} \cdot \Delta T}$$

ie, $$n = 3(2\Delta T - 1)$$

The increase in surface of the space-time causes a wave in it. The frequency of the energy quantum-wave,

$$\nu = (\text{increase in surface of space time}) / \Delta T$$

$$= \{\prod r(l - r)\} / \Delta T$$

Ie, $$\nu = \pm (\prod \Delta T)/3 \quad \ldots\ldots.(12)$$

The '$\pm$' sign in equation (12) tallies with the existence of antiparticles to particles.

Now, placing $\Delta T = \pm (3\nu/\prod)$ from equation (12) in equation (10), we get,

$$h\nu = \pm (3c\nu/\prod)^{4i}$$

i.e., $$h = \pm \{(3c/\prod)^{4i} \nu^{4i-1}\} \quad \ldots..(13)$$

$(3c/\prod)^{4i}$ being considered constant, h is proportional to ν^{4i-1}

The value of h depends upon the frequency concerned. The graph of h versus ν^{4i-1} (as shown in fig.7) is a monotonously increasing one. For most part of the energy range that we deal with, h may be thus taken to be a constant. However, h seems not to be a constant in the strictest sense.

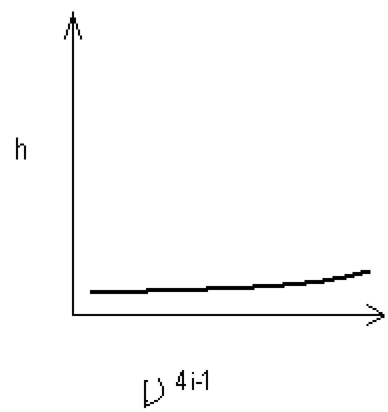

Fig 7: h-ν^{4i-1} graph.

Conclusion:

Though the angles of spread of various wavelengths are quite small, yet making use of an intermediate wavelength between two given wavelengths in an experimental set-up allows us to detect such spreading. Experimental values tally with theoretical ones.

A minimum distance must separate two given wavelengths for us to distinguish them. This minimum distance depends upon the difference between the concerned wavelengths. Experiment to study this gives us the value of the constant of proportionality between the two.

The energy quantum is studied in the light of the Study of Abstraction and the Laws governing Physical Transactions. The plank’s constant (h) appears to be a very monotonously increasing function instead of being a constant in the strictest sense of the term.