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On the dark covering capacity of light and the unification of dark with light

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Abstract:

Light has properties such as polarization, interference, diffraction etc. This paper presents the new property of light and its relation with dark. This relation is also useful for the describing dark in terms of light's parameter. We treated dark as an absence of light but this paper presents dark's systematical description and hence presents dark's relation with light.

Keywords:

Dark; Hor; intensity of light; dark covering capacity of light; cuboid of volume V; covers.

1) Introduction:

"What is light?" this question has been studying since from long time. After great wave-particle struggle physics now reach to the fact that light is wave as well as particle (p. 6-7 [1]). Phenomenon such as photoelectric effect etc. can be well explained by the particle nature of light (p. 355-358 [2]) and phenomenon such as polarization, interference, diffraction etc. can be well explained by the wave nature of light (p. 360 [3]). Though wave nature, particle nature, polarization, interference, diffraction etc. are the distinguishable from each other, they are properties of light. But why does light have its own shine? This question is of physical importance and answer to this question can't be given by the above mentioned properties of light.

In present work, not only new property of light but also its relation with dark is described and this relation gives better approach to the solution of question why does light have its own shine? We treated dark just as an absence of light but this paper describes dark in new point of view. In section 2, there is given introductory approach to the relationship between the light and dark and on the basis of this relationship one thought experiment is described. In section 3, a brief mathematical description of light and dark relation is given. In what sense light requires medium for propagation through empty space is described in section 4 and conclusions of this work is given in section 5.

2) Introductory approach to relation between the light and dark:

When we look deep into nature then everything gets clear. Light and dark are deeply connected; relationship between light and dark is quite simple as like relationship between bed and bedspread. When bed is covered by the bedspread at that time we can't see the bed but we can see the bedspread but bed is still present within the bedspread if this relation of bed and the bedspread is apply to the light and the dark then everything gets clear. In case of light and the dark, treat dark as a bed and light as a bedspread like bed and bedspread light also covers the dark so we can't see the dark but we can see the light but dark is still present within the light. Each light has its own ability to cover the dark which depends on the intensity of a light in a given volume at a given instant. Each light covers the dark which is equal in magnitude to the intensity of a light in a given volume at a given instant. Ability of light to cover the dark is the reason of why does light have its own shine? Since light has its own shine irrespective of its wave or particle nature so, it doesn't matter whether light is a wave or particle but still light will cover the dark. As light has property to cover the dark so light has its own shine. If materials doesn't able to cover the dark then those materials won't have their own shine. This relation between light and dark can be useful for giving an explanation for a thought experiment which is as follow:

Suppose if we flash a laser light in the glass made box which is exposed to the sunlight then at that time we will see relatively minimum intensity of a laser light in the glass made box. But if we flash same laser light in the same glass made box but now glass made box is exposed to the CFL bulb light then at that time we will see relatively maximum intensity of a laser light in the glass made box. Now question is why and how this happens? Its answer is quite simple if we consider dark as a measurable physical quantity. When glass made box exposed to the sunlight at that time sunlight covers relatively more amount of dark (sunlight covers some amount dark out of total amount of dark that presents inside of the glass made box) than CFL bulb light. Here sunlight covers the dark which is equal in magnitude to the sunlight's intensity inside of the glass made box at a given instant. As sunlight covers relatively more amount of dark so there is remains small amount of dark within the glass made box for a laser light and laser light covers this small amount of dark as laser light covers this small amount of dark which is equal in magnitude to the laser light's intensity in the glass made box at a given instant hence we see relatively minimum intensity of a laser light in the glass made box in presence of sunlight. But when this glass made box exposed to the CFL bulb light then at that time CFL bulb light covers relatively less amount of dark (CFL bulb light covers some amount dark out of total amount of dark that presents inside of the glass made box) than sunlight. Here CFL bulb light covers the dark which is equal in magnitude to the CFL bulb light's intensity inside of the glass made box at a given instant. As CFL bulb light covers relatively less amount of dark so there is remains significant amount of dark within the glass made box for a laser light and laser light covers this significant amount of dark as laser light covers this significant amount of dark which is equal in magnitude to the laser light's intensity in the glass made box at a given instant hence we see relatively maximum intensity of a laser light in the glass made box in presence of CFL bulb light. As sunlight has relatively high intensity than the intensity of a CFL bulb light hence sunlight covers relatively more amount of dark than CFL bulb light. From this discussion I am going to introduced new physical quantity for describing the dark. This quantity shows that the amount of intensity of given light required for covering unit amount of dark in a given volume at a given instant. For our simplification let call this new physical quantity as Licap and denote by capital letter L. Licap is a basic general form for describing the dark and licap is the representation of "Light covers the dark" this statement. As mentioned licap shows that the amount of intensity of the given light required for covering unit amount of dark in a given volume at given instant so licap is purely depends on the intensity of the given light in a given volume at a given instant.

3) Mathematical description of a light and the dark relation:

During giving mathematical description of the light and dark relation we have to consider dark not only as an absence of light but also as a measurable quantity having specific magnitude. First I have to clarify the meaning of one statement I have been using this statement in previous section and this statement is "Light covers the dark which is equal in magnitude to intensity of a light in a given volume at a given instant". Clarification of this statement is as follow:

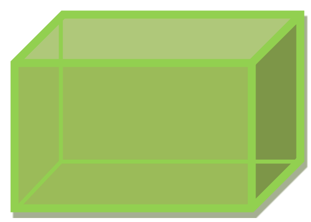

Figure 1: Hypothetical cuboid producing green light.

Let us consider the hypothetical cuboid of volume V (as shown in figure 1) which is kept in a dark place and this hypothetical cuboid has ability to produce its own light from inside in such way that intensity i of this light remains uniform throughout the hypothetical cuboid's volume V. Mathematical representation of the statement "Light covers the dark which is equal in magnitude to intensity of a light in a given volume at a given instant" for hypothetical cuboid can be given as:

$$i = \in_i \tag{1}$$

Where $\in_i$ is the magnitude of the dark covered by intensity i of a light in the hypothetical cuboid. Even after covering specific amount of dark $\in_i$ within the hypothetical cuboid by its own light having intensity i there is still remains some amount of dark having magnitude $\in_r$ out of total maximum amount of dark D within the hypothetical cuboid and hence connection between $\in_i$, $\in_r$ and D given by relation:

$$\in_r = D - \in_i \tag{2}$$

In Eq. (1) only magnitudes are equal but their units are different. For our simplification let us assume that the unit of dark is a Hor and denoted by capital letter H now by adjusting Eq. (1) and Eq. (2) I have:

$$i = D - \in_r \tag{3}$$

3.1) On the concept of Maximum Amount of Dark (MAD) *D* in a given volume:

The maximum amount of dark is a dark which is naturally enclosed by the given volume. Imagine the cuboid of volume V if intensity of a light inside of the cuboid is totally equal to zero i.e. if there is no light present inside of the cuboid then the dark present inside of the cuboid is called as maximum amount of dark which is naturally enclosed by any given volume as every volume enclosed maximum amount of dark depending on its volume so maximum amount of dark is constant for given volume but different for different-different volumes.

3.2) On the mathematical unification of the light and dark:

Again consider the same hypothetical cuboid of volume V (as shown in figure 1) as mentioned this hypothetical cuboid has ability to produce its own light from inside in such way that intensity i of this light remains uniform throughout the hypothetical cuboid's volume V. In section 2, I had described the new physical quantity which is licap L. Licap shows that the amount of intensity of given light required for covering unit amount of dark in a given volume at a given instant so mathematical representation of licap on the basis of its definition can be given as:

$$L = \frac{i}{D} \tag{4}$$

Where i is the intensity of hypothetical cuboid's own light from inside and D is the maximum amount of dark enclosed by the hypothetical cuboid's volume V. As assumed earlier that the unit of dark is Hor H and we know that unit of intensity of light is candela Cd [4] so obviously from Eq. (4) the unit of licap will be $\frac{Candela}{Hor}$ i.e. $\frac{Cd}{H}$. Suppose intensity of a light in the hypothetical cuboid is changing with time t due to this change obviously both $\in_i$ and $\in_r$ also goes on changing with time t then due this differentiating Eq. (3) with respect to time t:

$$\text{Therefore, } \frac{di}{dt} = \frac{dD}{dt} - \frac{d\in_r}{dt} \tag{5}$$

Where $\in_r$ is a magnitude of the remaining amount of a dark in the hypothetical cuboid and $\in_i$ is a magnitude of a dark covered by the hypothetical cuboid's own light from inside. As mentioned in subsection 3.1, D is a constant for given volume therefore D is also constant for the mentioned hypothetical cuboid's volume V so due to this Eq. (5) becomes:

$$\text{Therefore, } \frac{di}{dt} = 0 - \frac{d\in_r}{dt}$$

$$\text{Therefore, } \frac{di}{dt} = -\frac{d\in_r}{dt} \quad (6)$$

Eq. (6) tells that the rate of change of intensity of a light in a given volume is equal to the negative rate of change remaining amount of dark in the same given volume. In Eq. (6) negative sign indicates that as one quantity decreases then other quantity increases and vice versa i.e. if intensity of light in a given volume increases then the remaining amount of a dark in the same given volume decreases and vice versa. From Eq. (1) and from Eq. (6) I have:

$$\text{Therefore, } \frac{d\in_i}{dt} = -\frac{d\in_r}{dt} \quad (7)$$

Here Eq. (7) tells us that as $\in_i$ increases then $\in_r$ decreases which theoretically as well as practically true. Now from Eq. (3) and from Eq. (4) I have:

$$\text{Therefore, } L = \frac{D-\in_r}{D}$$

$$\text{Therefore, } L = 1 - \frac{\in_r}{D} \quad (8)$$

As intensity of a light in the hypothetical cuboid is changing with time t so due to this licap L of a light for the hypothetical cuboid and remaining amount of dark $\in_r$ in the hypothetical cuboid also goes on changing with time t but D is a constant for the hypothetical cuboid of volume V. So differentiating Eq. (8) with respect to time t:

$$\text{Therefore, } \frac{dL}{dt} = 0 - \frac{1}{D}.\frac{d\in_r}{dt}$$

$$\text{Therefore, } \frac{dL}{dt} = -\frac{1}{D}.\frac{d\in_r}{dt} \quad (9)$$

From Eq. (6) and from Eq. (9) I have:

$$\text{Therefore, } \frac{dL}{dt} = +\frac{1}{D}.\frac{di}{dt} \quad (10)$$

Now differentiating Eq. (4) with respect to time t:

$$\text{Therefore, } \frac{dL}{dt} = +\frac{1}{D}.\frac{di}{dt} \quad (11)$$

From Eq. (10) and from Eq. (11) clearly we see that Eq. (1)-(4) and Eq. (6)-(7) are true. Actually here I introduced licap because for describing the dark in terms of a light. This licap is a basic general form for describing the dark.

3.3) On the measurement problem of a licap and its solution:

Licap depends on the intensity of a light but, since intensity of a given light changes with a distance from the light source hence due to this licap also changes with a distance from source of the given light. Then

"How to measure the net licap L of given light by keeping the intensity of that light uniform in the open volume of free space?" Actually the net licap L shows that the unit amount of the dark covered by the given light in the open volume of free space. As licap depends on the intensity of the given light hence if two or more lights having same intensity occupies same volume of free space (here in this case magnitudes of different-different occupied volumes of free space by two or more lights are same hence those occupied volumes has same values of maximum amount of dark D) then the values of licaps of those two or more lights are also same so licap is not constant for given light but actually licap is a constant for same values of i and D. "How to measure the net licap L of given light by keeping the intensity of that light uniform in the open volume of free space?" I can solve this question from the following explanation:

Suppose 3 simple glass made cuboid namely as A, B and C are kept in front of light source and light from this source is falling on this 3 cuboids. Cuboid A, B and C has same infinitesimally small volume dv. I considered this infinitesimally small volume because intensity of light from source will remain uniform throughout each cuboid's individual volume. Since volume of each cuboid is same hence each three cuboid will enclose the same maximum amount of dark D but, intensity of light decreases as the distance from source increases hence intensity of light from source will not same for all three cuboids but remains uniform throughout each cuboid's individual volume.

Let us consider that d_1, d_2 and d_3 be the horizontal distance of cuboid A, B and C from light source respectively and $d_1 < d_2 < d_3$. As $d_1 < d_2 < d_3$ then obviously it leads to an inequality:

$$i_1 > i_2 > i_3 \tag{12}$$

Where i_1, i_2, and i_3 are the intensity of light from source in cuboid A, B and C respectively. Here maximum amount of dark enclosed by each 3 cuboid is same which is equal to D. Hence from inequality (12) I have:

$$i_1 > i_2 > i_3$$

$$\text{Therefore, } \frac{i_1}{D} > \frac{i_2}{D} > \frac{i_3}{D}$$

$$\text{Therefore, } L_1 > L_2 > L_3 \tag{13}$$

Where L_1, L_2 and L_3 are the small components of net licap L of the light from source for cuboid A, B and for C respectively. Here L_1, L_2 and L_3 are same for cuboid A, B and for C respectively because I assumed infinitesimally small volume of each 3 cuboids. Now Suppose if we construct the imaginary cuboids inside of the given light from given source of given power in such a way that all imaginary cuboids will cover all light intensity and intensity of that light will remain uniform throughout each cuboid's individual volume but, obviously intensity of that light would different for different-different imaginary cuboid's volume it is because every imaginary cuboid's distance from source is different (here volume of each imaginary cuboid must be infinitesimally small due to this intensity of the light remains uniform throughout the each imaginary cuboid's individual volume). As I am adjusting the volume of each imaginary cuboid in such a way that all imaginary cuboids will cover all light intensity. During this adjustment process volumes of all imaginary cuboids will not same so due to this enclosed maximum amount of dark will different for different-different imaginary cuboid's volume but, enclosed maximum amount of dark will constant for the given imaginary cuboid's individual volume. This explanation can be demonstrated with the help of a thought experiment which is as follow:

Let us consider a light from the source of given power which is situated at the dark place and we want to measure the net licap of this light for that assume the light from the source of given power is totally covered by the n imaginary cuboids of different volumes. Volume of each n imaginary cuboid is infinitesimally small so that intensity of light will remain uniform throughout each cuboid's individual volume. As volumes of each n imaginary cuboids are different hence maximum amount of dark enclosed by each n imaginary cuboids will also different but same for given imaginary cuboid's individual volume. As light from source is covered by n imaginary cuboids volume so now consider the followings:

Let i_1, i_2, i_3, …, i_n be the intensity of light from source in first imaginary cuboid's volume, in second imaginary cuboid's volume, in third imaginary cuboid's volume and in n^{th} imaginary cuboid's volume respectively. Let D_1, D_2, D_3, …, D_n be the maximum amount of dark enclosed by the volume of first imaginary cuboid, by volume of second imaginary cuboid, by volume of third imaginary cuboid and by volume of n^{th} imaginary cuboid respectively and let L_1, L_2, L_3, …, L_n be the small components of the net licap of a light from source for first imaginary cuboid's volume, for second imaginary cuboid's volume, for third imaginary cuboid's volume and for n^{th} imaginary cuboid's volume respectively then from Eq. (4) I have:

$$L_1 = \frac{i_1}{D_1} \tag{14}$$

Here Eq. (14) is a component of the net licap of light from source for first imaginary cuboid's volume also:

$$L_2 = \frac{i_2}{D_2} \tag{15}$$

Here Eq. (15) is a component of the net licap of light from source for second imaginary cuboid's volume and:

$$L_3 = \frac{i_3}{D_3} \tag{16}$$

Here Eq. (16) is a component of the net licap of light from source for third imaginary cuboid's volume now for n^{th} imaginary cuboid's volume:

$$L_n = \frac{i_n}{D_n} \tag{17}$$

Here Eq. (17) is a component of the net licap of light from source for n^{th} imaginary cuboid's volume now let L be the net licap of a light from source of a given power hence the net licap L of a light from source of given power will be:

$$\text{Therefore, } L = L_1 + L_2 + L_3 + \cdots + L_n \quad (18)$$

Now from Eq. (14)-(18) I have:

$$\text{Therefore, } L = \frac{i_1}{D_1} + \frac{i_2}{D_2} + \frac{i_3}{D_3} + \cdots + \frac{i_n}{D_n} \quad (19)$$

$$\text{Therefore, } L = \sum_{r=1}^{n} \frac{i_r}{D_r} \quad (20)$$

From this discussion I have solved the question of "How to measure the net licap L of the given light by keeping the intensity of that light uniform in the open volume of free space?" As mentioned that the net licap is a licap of the given light in the open volume of free space (open volume of free space is that volume where whole intensity of the light is present).

3.4) On the range of the licap:

From Eq. (4) licap is given by relation:

$$L = \frac{i}{D}$$

But intensity of light is always real and positive i.e. $i \geq 0$ (p. 449-452 [3]) and every volume enclosed some maximum amount of dark D so its magnitude is also real and positive but not equal to zero i.e. $D > 0$. As $i \geq 0$ and $D > 0$ so I can write that:

$$L = \frac{i}{D} \geq 0$$

$$\text{Therefore, } L \geq 0 \quad (21)$$

Also from Eq. (8) I have:

$$L = 1 - \frac{\epsilon_r}{D}$$

But $D > 0$ and remaining amount of dark ϵ_r has also real and positive magnitude. If light covers all dark inside of the given volume then remaining amount of dark ϵ_r become equals to the zero i.e. $\epsilon_r \geq 0$. As $D > 0$ and $\epsilon_r \geq 0$ so I can write that:

$$\frac{\epsilon_r}{D} \geq 0 \quad (22)$$

From Eq. (8) and from inequality (22) I can write that:

$$L \leq 1 \tag{23}$$

Now from inequality (21) and from inequality (23) obviously I can write the range of licap as follow:

$$0 \leq L \leq 1 \tag{24}$$

4) Does light also require medium for propagation:

Suppose if someone adjust the intensity of a light in the hypothetical cuboid (as shown in figure 1) in such a way that this light intensity will cover all the maximum amount of dark D within the hypothetical cuboid of volume V due to this there will remain zero amount of dark (i.e.$\in_r = 0$) within the hypothetical cuboid and at that time no dark will remain inside of the hypothetical cuboid. So due to this no other light will able to cover the dark within the hypothetical cuboid and if no other light will able to cover the dark within the hypothetical cuboid then this other light will not able to propagate through the hypothetical cuboid. Even we will also unable to see through the hypothetical cuboid and that is what we called as an intense saturation of a light intensity in specific region. This is our common experience that if we look toward the region where there is a high saturation of the intensity of a light then at that time we are unable to see through this region. If light covers all the maximum amount of dark D within the hypothetical cuboid then at that time magnitude of the maximum amount of dark will equal to the intensity of a light in the hypothetical cuboid at that instant. Hence on the basis of Eq. (1) I can write:

$$D = i \tag{25}$$

Now, on the basis of Eq. (3) and Eq. (25) I can write Eq. (26):

$$\text{Therefore, } D = D - \in_r \tag{26}$$

$$\text{Therefore, } \in_r = 0 \tag{27}$$

Here on the basis of equation (27) we can see that no dark will remain at this situation for covered by other light and due to this; this other light will unable to propagate through the hypothetical cuboid of volume V. From the discussion in this section I have tried to show that light also requires medium for propagation through an empty space and this medium is provided by the dark itself. All the above explanations and equations are also same for universally and also applicable for any given volume but, condition is that the intensity of a light in the specific region or in the specific volume should be uniform.

5) Conclusions:

Dark is not only an absence of a light but also it is a measurable quantity having magnitude and unit. For propagation of a light through an empty space there should require dark. Light covers the dark which is equal in magnitude to intensity of a light in a given volume at a given instant. The maximum amount of dark D is different for different-different volumes but constant for the given volume. Since light have ability to cover the dark so light have its own shine; in general anything which has ability to cover the dark, shine.

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