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Area Of Photon And Electron Are The Major Evidence To Causes Ejection Of One Electron By One Photon And Show Photon Is Composition.

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Key Words

Cross-section area, Distribution of energy, Photon is composition, Field, Matter, Photoelectric effect, Compton effect, Raman Effect, Matter-light interaction etc.

ABSTRACT

The objective of this work is to show photon is a composition, for this we are using numerical value of area of photon and electron, and develop some theoretical model. In numerical value we calculate the cross-section area of electron and photon, and found that the surface area of a single electron is very very small than that of photon which is incidence on it. So when the photon of large cross-section area incidence on electron electron only absorbed the energy of those part of photon which is in contact with it but not those part of photon energy which is certain distance away from it. So, if the energy absorbed by electron from photon cross-section area is greater than the work function than electron again needed kinetic energy to eject from the surface and for this electron re-absorbed the surrounding remain energy of photon. These remain energy of incidence photon indicate that it is composition which we can call tiny segment photon in other word. This phenomena are seen in cases of photoelectric effect, Compton effect, Raman effect and other type of matter-light interaction. These phenomenon is only possible if photon is composition because composition photon only can goes on distribution of energy.

INTRODUCTION

When the bundle of photon incidence on the surface of consider material the energy of bundle photons goes to distributed to consider surface of material. Now, if we consider a single photon from the bundle then the energy of this photon also goes to distribution to the consider surface of material. The distribution of the energy of single photon is only possible if it is composition i.e. photon has tiny segment photon in side it.

Let the source emit the light or photon and photon incidence on the surface of an electron. In figure we are consider three track T_1, T_2 and T_3 among these three, T_1 and T_2 indicate the track of photon incidence on the surface of a electron partially. During the partially incidence on the surface of electron photon can not transformer its total energy to electron and electron are unable to leave the orbit of an atom but the track between T_1 and T_3 of photon are able to transfer the energy to electron sufficient and electron are able to leave the orbit of an atom. Example T_2 tack photon are able to transfer the energy to electron or electron area able to observed the energy from the photon.

Figure 1 show the incidence of photon from the source to an electron at different position of electron i.e. either at center or at corner or partially. But the phenomenon of photoelectric effect is only causes by central incidence photon on electron because it has maximum contact with electron and transfer the maximum energy to electron while other photon is less than that of central photon.

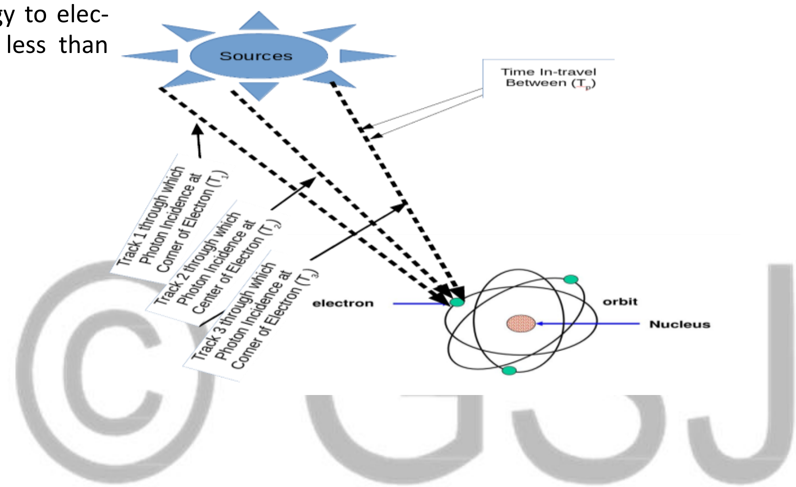

Figure 1: Incidence of Photon on electron at difference position.

Figure 2 indicate the incidence of the photon from sources to an electron partially and unable to kick the electron from the atom due to less observation of energy from photon or only partially observation of photon energy.

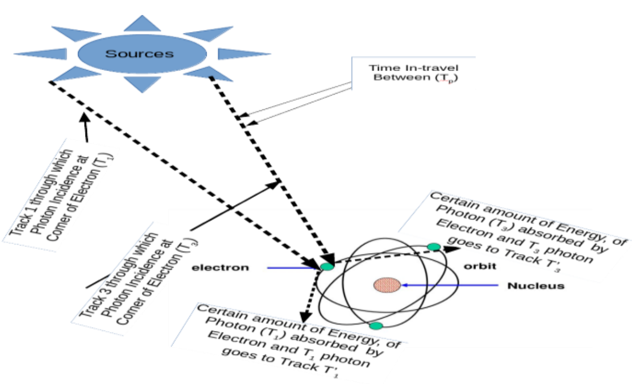

Figure 2: Phenomena of Photon when partially interact with electron corner and electron doesn't goes on excited state.

Figure 3 indicate the incidence of the photon from sources to an electron fully and able to kick the electron from the atom due to sufficient observation of energy from photon or only fully observation of photon energy.

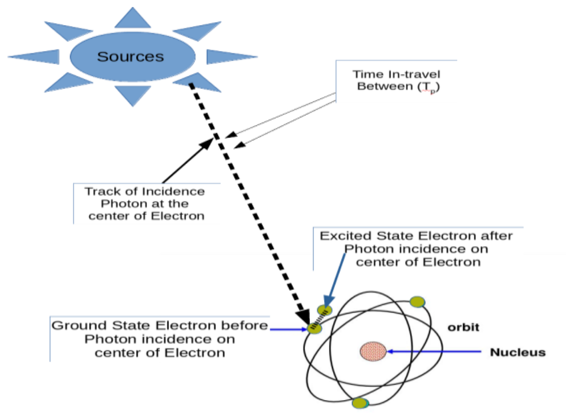

Figure 3: Excitation of electron when photon incidence at center of electron.

We have from planks distribution law for monochromatic (or spectral) energy density of radiation and given by

$$U(\nu,T)=\frac{8\pi h}{c^3}\frac{\nu^3}{\exp(\frac{h\nu}{kT})-1}\text{..............................}(1)$$

[1,2] (Plank distribution law).

$$dE_V = \frac{8\pi h}{c^3}\frac{\nu^3}{exp\left(\frac{h\nu}{kT}\right)-1}d\nu dV\text{............................}(2)$$

Similar for surface area dA the energy distribution from (2) is given as

$$dE_A = \frac{8\pi h}{c^3}\frac{\nu^3}{exp\left(\frac{h\nu}{kT}\right)-1}d\nu dA\text{..................................}(3)$$

For, monochromatic intensity, B (ν, T), is generally related to the differential amount of radiant energy, dE, that crosses an area element, dA, in directions confined to a differential solid angle, dΩ, being oriented at an angle θ to the normal of dA is given as

$$dE = B(\nu,T)cos\theta dAd\Omega d\nu dt\text{.........................}(4)$$

, in the time interval between t and t + dt and the frequency interval between ν and ν + dν.

Thus with the help of above we can obtained

$$dE = \frac{4\pi}{c}B(\nu,T)cos\theta dA\frac{d\Omega}{4\pi}cdtd\nu = \frac{4\pi}{c}B(\nu,T)d\nu dV\text{................}(5)$$

The quantity dΩ/(4π) in (5) above expresses the probability of radiation propagation in a certain direction.

Also, we have relation B(ϑ, T) dϑ = B (ν (ϑ), T) dν , where ϑ stands for any variable like radian frequency, ω, wavelength, λ related to the frequency ν via the transformation ν (ϑ), [3].

Individual photon detection can be treated as independent events that follow a random temporal distribution. According to classic Poisson process, and the number of photons N measured by a given sensor element over a time interval t is described by the discrete probability distribution

$$Pr(N = k) = \frac{e^{-\lambda t}(-\lambda t)^k}{k!}\text{..................}(6)$$

where λ= Expected number of photons per unit time interval, λt= rate parameter that corresponds to the expected incident photon count [4].

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Review

Boltzmann has shown that the entropy of a monatomic gas in equilibrium is equal to $\omega Rln(P_0)$ where P_0 is the number of possible complexions corresponding to the most probable velocity distribution, R being the well known gas constant, ω the ratio of the mass of a real molecule to the mass of a mole, which is the same for all substances. But for, according to the electromagnetic theory of the radiation the velocities of the atoms are completely independent of the distribution of the radiation energy, the total number of complexions is simply equal to the product of the number relating to the velocities and the number relating to the radiation and for total entropy we have, $f[ln(P_0R_o)] = f(lnP_0) + f(lnR_0)$ and where f is a factor of proportionality [5].

Planks uses Maxwell-Boltzman statistics to calculate the radiation energy and according to him at temperature T the numbers of oscillation having energy nhv is given by ,

$$N_n = A\exp\frac{-nh\,\nu}{kT}$$

where K is boltzman Constant. The total energy of oscillation having energy nhv is given by $E_n = nh\nu N_n$, total energy of all oscillation in black body is $E = \sum E_n$ and total oscillation in black body is $N = \sum N_n$ [6].

For the case of normal clinical exposures, the X-ray CT measurements zi are often modeled as the sum of a Poisson distribution representing photoncounting statistics and an independent Gaussian distribution representing additive electronic noise [7].

$$P(n) = \frac{n^{-n}e^{-n}}{n!}$$

This Poisson equation, is also the distribution is for a light source where individual photons are independent of one another and the source is rated at an average intensity. The thermal light field is an example where light fired is a superposition of many wave states with random amplitudes and phases, caused by the exciting of individual atoms randomly and coherence time property comes into play [8].

The probability of finding a proton inside the atom, and more specifically, inside the nucleus

is given by

$$P_n = \frac{\sigma_n}{\sigma_a} = \frac{1.22\,A^{\frac{2}{3}}}{r_a^2}$$

$$P_e = \frac{\sigma_n}{\sigma_a - \sigma_n} = \frac{r\,e^2}{r_a^2 - 1.2^2\,A^{\frac{2}{3}}}$$

and electron is give as

where: r_a is the atomic radius, r_e is the electron radius, r_n is the nucleus radius, and r_p is the proton radius [9].

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Proton charge radius from electron scattering experiments has stabilized around $0.87 - 0.88fm$ with an average of $r_p = (0.\quad .006)fm$. Also, CODATA2010 value of $r_p = (0.\quad .0051)fm$ is based on electron scattering and Lamb shift measurements from regular hydrogen [10].

According to CPH theory a photon contains n number of CPH that they are moving with the speed of c in the structure of photons. The given mass of a CPH is m, so its momentum is $P = mc$and the momentum of photon is $P = nmc$[11].

According to the results of reconsidering relativistic Newton's second law, one can definitely say that the best way for unifying the interactions is generalizing interaction between charged particles to photon structure and vice versa. This new view on photon means that we can redefine the graviton and electromagnetic energy. Attention to photon structure and using new definitions for graviton, we can use the subquantum space to describe the nature of time in order to understand better the nature of space-time, and review of thermodynamics laws and entropy [12].

Methodology

Let us consider the cross-section area of the pinhole through which the photon is passes is A_p and and incidence on the surface area of electron A_e. The incidence photon have such amount of energy hf which is capable for photoelectric phenomena after incidence on the surface of materials. Since the cross-section are of incidence photon is less than the surface area of consider the atom, then the probability of incidence photon on the surface area of a atom of material is greater i.e. approximately equal to 1. Moreover, the probability of ejecting the electron from the atom is one to one when photon meet the electron of an atom.

When a bundle of monochromatic light (from Laser: 5V DC Laser Diode) of certain energy passes through the hole of cross section area $0.785 \times 10^{-6} m^2$ incidence on the surface of poly silicon surface (Solar Panel: Resun-Solar 107-61 4V) the cross-sectional area of single photon was found $A_p = 6.465066886 \times 10^{-23} m^2 = 6.465066886 \times 10^{-19} cm^2$[13].

Now classically the radius of an electron we have

$$r_e = \frac{e^2}{m_e c^2} \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

[14]. where, m_e= mass of electron, c= velocity of light an e= charge of electron on putting the standard classical value of these in equation (1) we gete $0.785 \times 10^{-6} m^2$.

On considering the electron is spherical

$$A_e = 4\pi r_e^2 = 4 \times 3.14 (2.82 \times 10^{-13} cm)^2$$

$$A_e = 99.882144 \times 10^{-26} cm^2 = 9.9882144 \times 10^{-25} cm^2$$

$$A_e = 9.9882144 \times 10^{-25} cm^2$$

On taking the cross-section are of photon and electron ratio we get,

$$\frac{A_p}{A_e} = \frac{6.465066886 \times 10^{-19} cm^2}{9.9882144 \times 10^{-25} cm^2}$$

$$\frac{A_p}{A_e} = 0.6472695346 \times 10^{-19+25}$$

$$\frac{A_p}{A_e} = 0.6472695346 \times 10^{6}$$

$$\frac{A_p}{A_e} = 647269.5346$$

$$A_p \approx 647269.5346\, A_e$$

Approximate, A_p~647267A_e

This show that the cross-section area of photon is greater than that of cross-section area of electron or surface area of electron by 647269.5346 times .

Since, A_p be the cross-section area of photon and A_e be the surface area of electron then when the photon incidence on the electron surface area then the remain area of photon is (A_p-A_e). As we have A_p= 6.5 x 10^{-19} cm^2 (for red photon) and A_e =99.882144 x $10^{-26} cm^2$.

Then remain area which is not in contact with electron when photon is centrally incidence on it is given as A_{ep}=(6.5×10^{-19}- $99.882144 \times 10^{-26}$) cm^2

A_{ep}=(6.5×10^{-19}- $9.9882144 \times 10^{-25}$) cm^2

A_{ep}=($6.5 - 9.9882144 \times 10^{-6}$) $\times 10^{-19}$ cm^2

A_{ep}=($6.5 -0.99882144 \times 10^{-5}$) $\times 10^{-19}$ cm^2

A_{ep}= $6.499990012 \times 10^{-19}$ cm^2

This is the remained area of photon which surround the electron and electron gain or absorbed an energy from it.

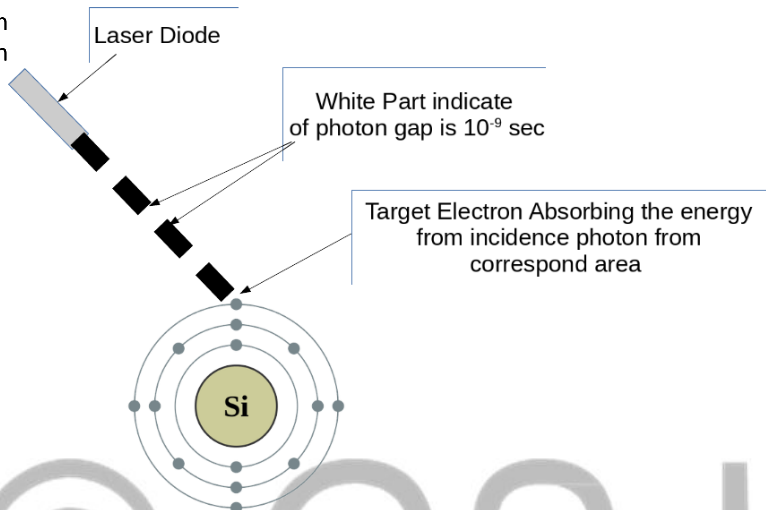

Figure 4: Incidence photon on target material atom-electron in 10^{-9}sec after emitted from diode laser.

Since the cross-section area of red photon is 6.5×10^{-19} cm^2 and the energy carries in this cross-section area is 1.78eV as the frequency of the red wavelength is 4.3×10^{14} Hz and h=6.62×10^{-34}J.s, which is calculated from hf= 4.3×10^{14} Hz x 6.62×10^{-34}J.s =1.78eV.

This implies that 1.78ev energy is contain on 6.5×10^{-19} cm^2 cross-section area of consider photon.

Or, 6.5×10^{-19} cm^2 cross-section area of photon carry at 1.78ev energy.

Or, $1cm^2$ cross-section area of photon carry at (1.78)/(6.5×10^{-19}) eV energy.

Since the surface area of electron is $99.882144 \times 10^{-26} cm^2$ and when photon incidence on it the energy of photon of cross-section area $99.882144 \times 10^{-26} cm^2$ is absorbed by electron i.e.

Therefore, $99.882144 \times 10^{-26} cm^2$ cross-section area of photon transfer the energy to electron ($1.78 \times 99.882144 \times 10^{-26} cm^2$.)/($6.5 \times 10^{-19}$) eV energy.

Or, $99.882144 \times 10^{-26} cm^2$ cross-section area of photon transfer the energy to electron 27.3523×10^{-7} eV energy.

Or, $99.882144 \times 10^{-26} cm^2$ cross-section area of photon transfer the energy to electron 2.73523×10^{-6} eV energy.

This show that when photon contact or incidence on the electron surface it transfer its energy of cross-section area $99.882144 \times 10^{-26} cm^2$ to electron at instant.

Also, the gaping of photon emitted from the laser diode is 10^{-9}sec this show that if the electron don't absorbed the total energy of incidence photon in 10^{-9} sec the photoelectric effect is impossible for suitable incidence energy photon.

This shows that the 1.78eV energy of photon having cross-section area 6.5×10^{-19} cm^2 is transfer to electron having surface area $99.882144 \times 10^{-26} cm^2$ in 10^{-9} sec.

From this we can also said,

An electron absorbed 1.78eV energy in 10^{-9} sec from cross-section area of photon 6.5×10^{-19} cm^2.

Or, 1eV $(10^{-9}/1.78)$sec

Or, 2.73523×10^{-6} eV $(2.73523 \times 10^{-6} \times 10^{-9}/1.78)$sec

Or, 2.73523×10^{-6} eV 1.5366×10^{-15}sec

This show that an electron absorbed 2.73523×10^{-6}eV from photon cross-section area

$99.882144 \times 10^{-26} cm^2$ in 1.5366×10^{-15}sec.

Now, the time taken to absorbed remain energy of photon is $(10^{-9} - 1.5366 \times 10^{-15})$ from remained area of photon $6.499990012 \times 10^{-19}$ cm^2.

More clearly we can say that 9.99×10^{-10} sec required to absorbed the remaining energy of photon from cross-section area $6.499990012 \times 10^{-19}$ cm^2.

RESULT AND DISCUSSION

As we know the laser emitted a photon with an in-travel of 10^{-9} sec and in our work we consider this situation. Since the cross-section area of photon of consider laser (red) is $6.465066886 \times 10^{-19}$ cm^2 and the energy of photon carrying in this cross-sections area is 1.78eV, which is absorbed by an electron of surface area $99.882144 \times 10^{-26} cm^2$ in 10^{-9} sec for photoelectric effect or phenomena. This show that if an material work function is 1.11eV (Solar Cell Type) then the energy of photon must be greater than 1.11eV for photo electric phenomena, in our cases we consider red photon whose energy is 1.78eV. Numerically, here we calculated a photon of $6.465066886 \times 10^{-19} cm^2$ incidence on electron surface having $99.882144 \times 10^{-26} cm^2$ cross-section area of photon transfer the energy to electron 2.73523×10^{-6} eV energy in 1.5366×10^{-15}sec and the remain energy of remain part of same photon is transfer in 9.99×10^{-10} sec.

CONCLUSION

From above, we have calculated time to transfer or absorbed of energy from a red photon to electron which going to take part in photoelectric effect. Here, time which we calculated play an important role to show that the photon is composition or contain tiny segment photon. That is a single photon to go the photoelectric effect having suitable energy take certain time to kick out the electron from the material atom and these time are discuss in result and discussion. In simply 2.73523×10^{-6} eV is absorbed in 1.5366×10^{-15}sec and $(1.78 - 2.73523 \times 10^{-6})$ needed 9.99×10^{-10} sec required to observed the remaining energy of photon from cross-section area $6.499990012 \times 10^{-19}$ cm^2. This time is only possible if photon is composition if photon is not composition the calculation is impossible to calculate.

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