Vishal's Photoelectric Effect

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Abstract - **Photo Electric effect in evacuated tube can be clear seen as the ejection of photoelectrons from negative potential cathode to positive potential anode when the light or any other electromagnetic radiation is illuminated. Let us briefly discuss the behavior of photoelectrons and photoelectric effect through evacuated tube. Let us consider a evacuated tube with cathode and anode which maintained at constant potential difference. Let us, we assume that the incident electromagnetic radiation has discrete and definite frequency, intensity. There may be other components which are kept constant. Here, There is an important component " Pressure " which is very negligible one, in the whole photo electric effect in evacuated tube. By seeing this negligible component (pressure) in the photo electric effect which takes place in evacuated tube, we can clearly say that the force between two electrons at a particular area increases, the whole photo electric effect get gradually decreases.**

keywords - **Universal Law Of Photoelectric Effect**

According to our judgment,
We can conclude that,

$$\rho \propto \frac{1}{\emptyset + {}^{1}/_{2}\, mv^2} - - - - - - - - 1$$

Similarly in this situation, we can introduce the constant (E_P) ↔energy of photon.
By removing proportionality,

$$\rho = \frac{E_P}{\emptyset + {}^{1}/_{2}\, mv^2} - - - - - - - - - - - - - 2$$

$$E_P = \rho \ (\emptyset + \tfrac{1}{2} mv^2)$$

In above equation pressure (ρ) is oftenly termed as photoelectric impedence. But equation 2 is not finalized one. Let us discuss about their correction.

Work Correction
We know that work function is defined as the minimum energy required to remove or move the electron from the metal surface. It is denoted as $\emptyset$.
Here we discuss deeply about work function in terms of charges of electrons. In electrostatics, the energy needed to move a charge from the point "P" to "R" is often known as electrostatics Potential energy "U". Here both the work function and the electrostatics potential energy is similar to each other. The work function can also be analyzed through the detailed study of electrostatic potential energy. Let us discuss about the similarities between work function and electrostatics potential energy.

Work function	Electrostatics potential energy
Energy Needed	Energy Needed
Displacement occurs	Displacement occurs
Measured in " ev "	Also measured in " ev "

And Hence , by using electrostatic potential energy ;

$$\Delta U = \int_{R_{io}}^{R_{eo}} \left(\frac{mv}{t}\right)_{elec} . dr - - - - - - - ③$$

$R_{eo} - represents\ extra\ orbitary\ notation$
$R_{io} - represents\ intra\ orbitary\ notation$
Time of momentized electron can be expressed in terms of charges as

$$\left(\frac{mv}{t}\right)_{elec} = -(-qE) = qE$$

Here –q indicates the charge of the electron substitute qE in equation ③

$$\Delta \cup = \int_{R_{io}}^{R_{eo}} qE \, . dr$$

We known that $E = \frac{v}{r}$ $\therefore$ Where v is the potential difference

$$\Delta \cup = \int_{R_{io}}^{R_{eo}} q\frac{v}{r} \, dr$$

Hence the work correction equation is obtained.

Vishal Photo Electric Equation :-

Above we discuss about the work correction. Let us substitute work correction expression in equation …(2).

$$E_p = \rho\left(\emptyset + \frac{1}{2} mv_e^2\right)$$

$$E_p = \rho\left(\Delta \cup + \frac{1}{2} mv_e^2\right)$$

$$E_p = \rho\left[\int_{R_{io}}^{R_{eo}} \frac{qv}{r} \, . dr + \frac{1}{2} mv^2\right]$$

Let us simplify the above expression as

$$E_p = \rho\left[\int_{R_{io}}^{R_{eo}} \frac{qv}{r} dr + \frac{1}{2} mv^2\right]$$

$$E_p = \rho\left[qv\int_{R_{io}}^{R_{eo}} \frac{dr}{r} + \frac{1}{2} mv^2\right]$$

$$E_p = \rho\left[qv\,[logr]_{R_{io}}^{R_{eo}} + \frac{1}{2} mv^2\right]$$

$$E_p = \rho\left[qv\,(log(R_{eo} - R_{io}) + \frac{1}{2} mv^2\right]$$

Here $\log(R_{eo} - R_{io}) = R_E$ is “existance”

So that

$$E_p = q\rho v(R_E) + \frac{\rho}{2} mv^2$$

for calculating total number of charge of electrons and it is represented as “nq”

$$E_p = nq\rho v(R_E) + \frac{\rho}{2} mv_e^2$$

$$E_p = nq\left(\frac{F}{A}\right) v\, R_E + \frac{\rho}{2} mv_e^2$$

$$E_p = \left[\frac{nq}{A}\right]\left[\frac{mv_e}{t}\right] v\, R_E + \frac{\rho}{2} mv_e^2$$

We know that total number of charges at total area is termed as intensity “ I “.

$$E_p = IP\left(\frac{1}{t}\right) v\, R_E + \frac{\rho}{2} m{v_e}^2$$

We know that $\frac{1}{t} = f$ $\therefore$ frequency

$$E_p = PIfvR_E + \frac{\rho}{2} m{v_e}^2$$

By introducing the concept of quantization of light

$$hv_f = PIfv(R_E) + \frac{\rho}{2} m{v_e}^2$$

finally Vishal Photoelectric Equation is derived as

$$hv_f = PIfv(R_E) + \frac{\rho}{2} m{v_e}^2$$

Universal law of Photo Electric Effect

At constant pressure and potential difference, the frequency of the incident photon is directly proportional to the intensity and momentum of photoelectron as well as the kinetic energy of the photoelectron.

Interpretation of Vishal’s Photo Electric Equation

Maximum kinetic energy is depends directly on frequency of the incident photons and indirectly on pressure.

Limiting Photo Electric Equation

When the total energies of the photons is exactly sufficiently equal to the potential energies of the photoelectrons then there is no kinetic energy of lack of kinetic energy is present in the electron. So that there is no existence of velocity of that election in special case :- V=0, P=0

hv_f= 0 (not Possible)

So that let we substitute the limit which tends to 0

$$hv_f = \lim_{V\to 0}\{ PIfv(R_E) + \frac{\rho}{2}\, mv_e{}^2\}$$

The above equation is considered as limiting photo electric equation.

VISHAL'S COERCION ELECTRIC EFFECT at GDT {GAS DISCHARGE TUBE } ;-

In absence of incident photon , there is a another way to conduct electricity in presence of medium. Such effect is called " COERCION ELECTRIC EFFECT ". when the pressure of the gas discharge tube is reduced around 110 mmHg using vacuum pump, it is observed that there is no discharge takes place. When the pressure is kept near 100mmHg, the discharge through gas tube take's place. Consequently, irregular streaks of light appears and also cracking sound is produced when the pressure is reduced in the order of 10mmHg the effect of coercion electric effect is keenly observed. By this we can clearly conclude that the pressure may be an important component which is also plays a very important role in coercion electric effect at constant potential difference.

By the above statement at some condition like, hv=0 and at some pressure,

The coercion electric effect can be expressed along with vishal's photoelectric equation is ,

vishal's photoelectric equation ,

$$hv_f = PIfv(R_E) + \frac{\rho}{2}\, mv_e{}^2$$

at condition in absence of photons $hv_f = 0$

The coercion photoelectric effect is expressed as,

$$0 = PIfv(R_E) + \frac{\rho}{2}\, mv_e{}^2$$

$$PIfv(R_E) = -\frac{\rho}{2}\, mv_e{}^2$$

$$v = -\frac{\rho}{2}\, mv_e{}^2 .(\, 1/\, PIf(R_E)\,)$$

By rearranging the above equation, as we get equation (5)

$$v = \{-\frac{1}{2}\, mv_e{}^2 .(\, 1/\, PIf(R_E)\,)\}.\, \rho$$

By comparing equation (5) with ohm's law ,

V = I . R

Coercion current (I_c) is obtained as ,

$$I_c = -\frac{1}{2}\, mv_e{}^2 .(\, 1/\, PIf(R_E)\,)$$