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Quantum Physics

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ABSTRACT - While researching quantum physics, I realized that I had just finished a book that was based on quantum theory. At the time, I didn't quite realize that quantum theory and quantum physics were interrelated. Niels Bohr once said, anyone who is not shocked by quantum theory has not understood it. He believed this because quantum physics makes the common laws of classical physics false on small scales.First, quantum physics is the physics of the incredibly small. It tries to explain the behavior of even smaller particles such as protons, neutrons, electrons, and even the particles that make up those particles. Would you believe that the model of an atom taught to us in chemistry is about 70 years out of date? In fact, an atom isn't just a nucleus with electrons looping around it. Instead of having a fixed place for the electrons to be, quantum physics gives us a statistical probability of the electron s location at any one moment.

These are the formulas derived from the extensions of the Heisenberg's Principle and the motion of the electron in an orbit, which are emitted by a photon.

KEYWORDS:

- **HEISENBERG'S UNCERTAINITY PRINCIPLE**
- **EINSTEIN EQUATIONS**
  1. **Photoelectric effect**
  2. **Relation Between Photon and Electron**

- **EXTENSION OF HEISENBERG'S PRINCIPLE**
  1. **Relation between Phase and Wavelength**
  2. **Relation between Phase and Velocity**
  3. **Relation between Phase and Position**
  4. **Relation between Phase and energy**
- **UTILIZATION OF ELECTRON**
- **EMISSION** OF PHOTON

INTRODUCTION:

1. **According to Heisenberg's principle, position and momentum of a particle can't be measured simultaneously with High Precision. There is a minimum for the product of the uncertainties of these two measurements.**
2. **While researching on Heisenberg's Principle, I derived some new formulas that marked the extension of Heisenberg's Principle.**
3. **Also, We apply nature of electron and photon both is related to each other and keeps common property. We know that when an electron moves at a very high speed its shows the wave character. In this wave nature the electron moves in the form of a wave and depicts a photon.**
4. **When a photon falls down on a metal surface, then an electron is emitted from the metal surface. It is known that a photon emits an electron at a time.**
5. **The project emphasis on the fact that can, this emitted electron reach in Orbit with the help of Einstein equation and angular momentum, also find that this electron are move in which orbit.**
6. **Using the energy parameters of frequency, kinetic energy, rotational energy, wavelength, threshold wavelength and area, we can find that in which orbit the electron can move.**
7. **.I know that when an electron are move in own orbit, then a electron has a specific**
8. **torque and this specific torque produce an electric power, we can check that this electron moves in an orbit or not .We find a new method to check the orbit by the help of Group velocity, phase velocity, phase difference, wavelength, angular velocity, time, angular wave number, any two parameter are used .**

These are the formulas derived from the extensions of the Heisenberg's Principle and the motion of the electron in an orbit ,which are emitted by a photon.

HEISENBERG'S UNCERTAINITY PRINCIPLE:

The position and momentum of a particle cannot be simultaneously measured with arbitrarily high precision. There is

a minimum for the product of the uncertainties of these two measurements. There is likewise a minimum for the product of the uncertainties of the energy and time.

$$\Delta x \, \Delta p \geq h / 4\pi$$

Δx=uncertantity position
Δp=change in momentum
h=plunck constant

EINSTEIN EQUATIONS:

1. **$hc/\lambda = W + KE_{max}$**
2. **$W = hc/\lambda_o$**
3. **$KE_{max} = 1/2 (M * V_{max} * V_{max})$**

Photoelectric effect :

The photoelectric effect occurs when light hits a metallic surface and ejects electrons. It proves that light is particulate—one of the major foundations of quantum mechanics.. This effects replicates that light are particles which are photons.

There are certain electron energy levels in an atom. If an electron absorbs enough energy, it will jump up to the next level. If it absorbs enough energy, it will jump up out of the highest energy level and out of the atom altogether.
The photoelectric effect occurs when the photon transfers enough energy to eject an electron from an atom in a metallic surface.

In experiments, they show various frequencies and intensities of light at a metallic surface. Above certain frequencies, the light would cause the electrons in the surface to be ejected. Under those frequencies, the photoelectric effect would not occur—the electrons remained in the surface. They found that it didn't matter how intense the light was, but only that it was higher than a certain frequency.

Relation Between Photon and Electron:

We apply nature of electron and photon both is related to each other and keeps common property. We know that when an electron moves at a very high speed its shows the wave character. In this wave nature the electron moves in the form of a wave and depicts a photon.
When a photon falls down on a metal surface, then an electron is emitted from the metal surface. It is known that a photon emits an electron at a time.
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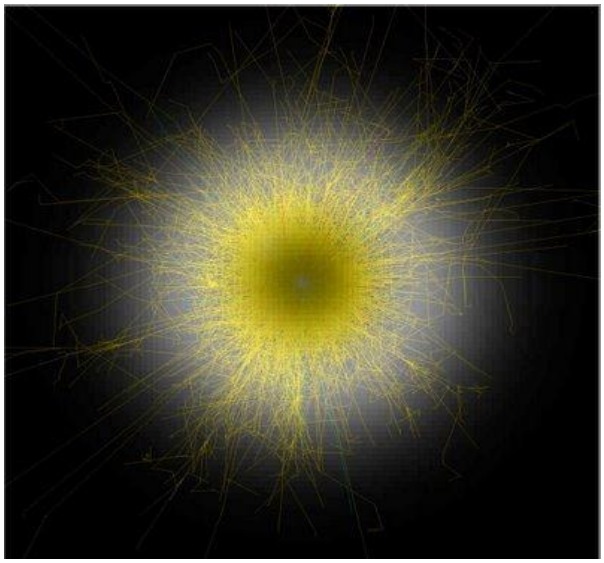


Terms :

- **h=Planck's constant (joule-second)**
- **λ=wavelength(meter)**
- **λo=threshold wavelength(meter)**
- **f=photon frequency(Hertz)**
- **fo=threshold frequency(Hertz)**
- **W=work function(Joule)**
- **hc/λ=photon energy(Joule)**
- **KE max=maximum electron energy(Electron Volte or Joule)**
- **c=velocity of light(Meter/second)**
- **M=mass of electron(Kilogram)**
- **v=velocity of electron(Meter/second)**
- **R=radius of orbit(Meter)**

hc/λ=W+ KEmax
W= hc/λo

KEmax=1/2 (M*Vmax* Vmax)
hc/λ=hc/λo+1/2(M*Vmax* Vmax)

We know that electron moving in a orbit satisfy the condition
mvr= nh/2π

Here we calculate the value of v

V=nh/2π*M*R
For Vmax
Vmax=nh/2π*M*Rmin

PROOF:

Put the value of electron velocity in Einstein equation:

hc/λ=hc/λo+1/2(M*(nh/2π*M*Rmin)*(nh/2π*M*Rmin))

Solve this and minimize term:

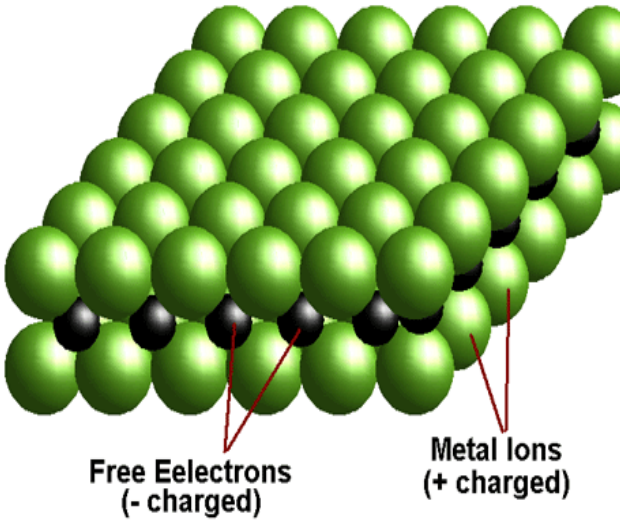
hc/λ=hc/λo+1/2((n*n)*(h*h/π)/4*π*Rmin*Rmin*M)this

This equation express in terms of area of orbit:

We know that area of orbit Amin=4*π*Rmin*Rmin

Now above equation is:

hc/λ=hc/λo+1/2((n*n)*(h*h)/M*(4*π*Rmin*Rmin*π))
Put the value of 4*π*Rmin*Rmin=Amin



Now the equation:

hc/λ=hc/λo+1/2((n*n)*(h*h)/M*Amin*π)

Divide by h
c/λ=c/λo+1/2((n*n)*(h)/M*Amin*π)

Photon frequency
f=c/λ
Work function frequency fo=c/λo

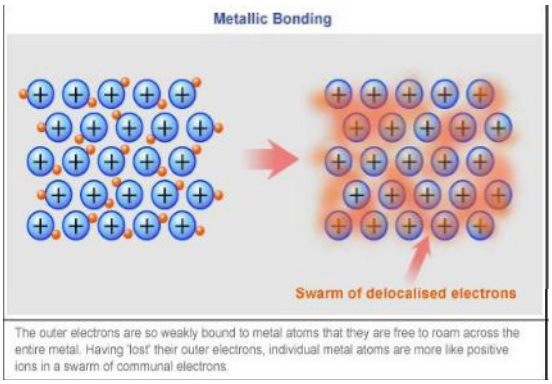
(f=fo+1/2((n*n)*h/M*A*π)
Calculate orbit n (which electron emit from metal in which orbit move)

2*(f-fo)*M*Amin*π/h=n*n
n=sqrt(2*(f-fo)*M*Ami n*π/h)

RESULT:
This n tell us about that electron move in a orbit.
Or we can say that a emitted electron in which orbit move. when a photon emit a electron.

MORE RESULT:

1. n=sqrt(2*(1/T-1/To)* M*Ami n*π/h)
2. n=sqrt(2* M*Ami n*π*(E-W)/h)
3.n=sqrt(2*c(1/λ-1/λo)Amin*M)
4.n=sqrt(2*p*(1/λ-1/λo Ami n/h)



REFERENCE:

Engineering physics
Modern A B C of physics
Web reference:
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CONCLUSION:

Thus with the help of this condition, an electron which is emitted by a photon can be thought to move in an orbit.

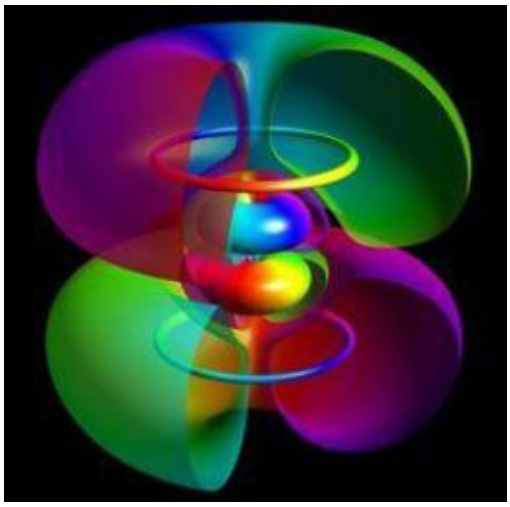
Also, we can find the number of that orbit.

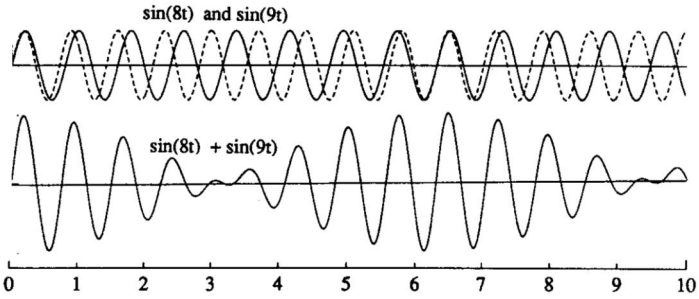
In addition, this could be used in the real life as well.

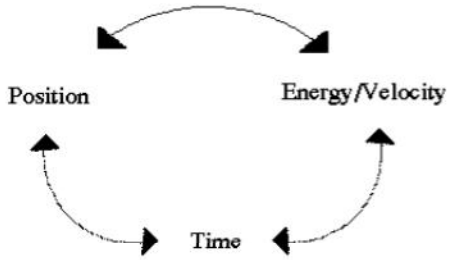
φ=phase difference
w=angular velocity
k=angular wave number (1/meter)

REFERENCE:
HEISENBURG'S UNCERTAINITY PRINCIPLE

We know that phase difference (φ)







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$\Delta x \, \Delta p \geq h / 4\pi$

Δx=uncertantity position
Δp=change in momentum
h=plunck constant

If the same Formula is derived using Phase Difference and Angular Velocity:

EXTENSION OF THIS FORMULA:

Φ this is also equal to 'kΔ x'

So

$\Phi = w\Delta t = k\Delta x$

Step 1 :) Calculate the value of Δ x in terms of w,t and k

$\Delta x = w\Delta t / k$

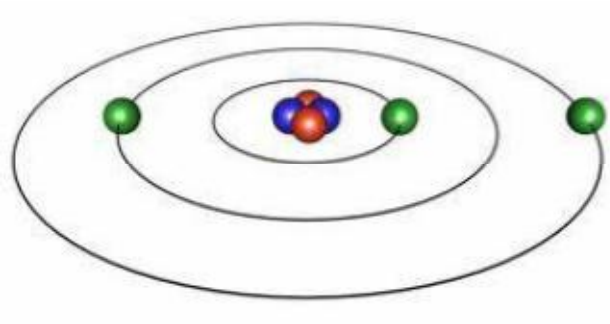
Step 2:) Put the value of x in Heisenberg's Uncertainty Principle

$\Delta x \; \Delta p = h / 4\pi$

$(w \Delta t/k) \Delta p = h / 4\pi$

Step 3 :) Now we place the value of small change in Momentum 'Δ p=dp'

Also: dp=dx/dt



dx/dt= Velocity of electron (meter/second)

Also we know that the relation between angular velocity and velocity

1) **'w=kv'**

Step 4:) Put the value of 'dp' in above Heisenberg's equation

We Get

2) **Δ xΔ p≥ h / 4π**

<u>From above equation</u>

3) **Φ=wΔ t= k Δ x**

<u>Step 5:) Calculate the value of Δ x in terms of Φ and k</u>

4) **Δ x= Φ/k**

Step 6 :)Put the value of □x and □p in Heisenberg's Uncertainty Principle

5) **Δ x Δ p ≥ h / 4 π**
6) **(Φ/k)(m dx/dt) ≥ h / 4 π**

Also , dx/dt=dv

7) **dw=kdv**

Step 7:) Calculate the value of v

8) **v=w/k**

Step 8:) Put the value of v in place of 'dx/dt'

9) **(Φ/k)(m dx/dt) ≥h / 4π**
10) **(dΦ/k)(mdv)= ≥h / 4π**
11) **(dΦ/k)(m dw/k) ≥h / 4π**

Step 9:) Put w=2π/ dt

dt= is a small change in time period

And k=2π/λ

Solving the above equation

<u>We get the formula</u>

1) **dΦ≥hdt/2m*λ*λ**

Also we can write the formula

Change dt= Δ t

Change dΦ= Δ Φ

Step 10:)<u>Now the resultant formula</u>

2) **Δ Φ≥h Δ t/2m*λ*λ**

p=h/λ

OR

Φ ≥p Δ t/2mλ

P=mv

OR

3) **Δ Φ≥ mv Δ t/2mλ**

<u>Minimize the term</u>

Δ Φ≥ vΔ t/2λ

v Δ t=dλ

Δ Φ≥ Δλ/2λ

Δλ=dλ

NOW

Δ Φ≥ dλ/2λ

Integrate both sides

Limit of dΦ is 0 to Φ and wavelength from λ1 to λ2

Result Obtained:

Δ Φ≥1/2(ln[λ1/λ2]

An additional result that can be derived from the above formula:

1. **Φ≥1/2(ln[E1/E2]**
2. **Φ≥1/2(ln[V1/ V2]**

3. Φ≥h*k*k/4π* Δω m .

SR NO.	FORMULA USED	NEW FORMULA
1.	Δx Δp ≥ h / 4 π (heisenburg's principle)	Φ≥1/2(ln[E1/ E2]) Φ≥1/2(ln[v1/ V2]) Φ≥h*k*k/4π*Δω* m Φ≥1/2(ln[λ1/λ2])
2.	Photoelectric equation E=hν E=m*c*c hc/λ=w+k.e. max	1. n=sqrt(2*(1/T-1/To)* M*Ami n*π/h) 2. n=sqrt(2* M*Ami n*π*(E-W)/h) 3. n=sqrt(2*c(1/λ-1/λo)Amin*M) 4. n=sqrt(2*p*(1/λ-1/λo Ami n/h

FIGURES AND TABLES:

Reference:

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Conclusion

It is an extension to the standard formula of HEISENBERG principal

Using these formula more results can be obtained which satisfies Heisenberg's PrinciplAn electron moves in a specific orbit if it satisfied the above condition

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