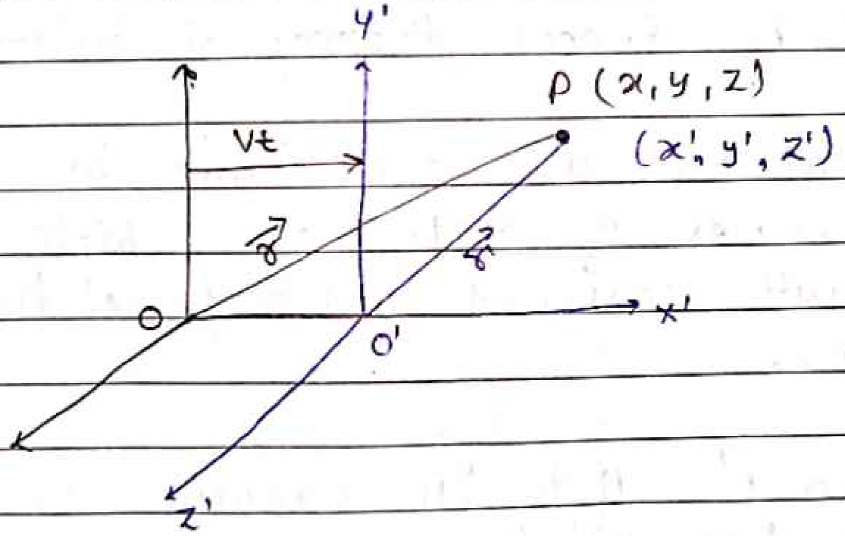
Section - B PHYSICS :-

(1) Galilean transformation :-

- To transfer the cordinates of a particle to one reference frame to the other reference frame this transformation of cordinates of a particle from one initial frame of reference to another initial frame of reference is called Galilean transformation.
Such set of transformation equations is called transformation equation



$$\vec{r} = \vec{r}' + vt \quad \text{Or} \quad \vec{r} = \vec{r}' - vt$$

$$\left.\begin{aligned} x' &= x - vt \\ y' &= y \\ z' &= z \end{aligned}\right\} \text{— (i)}$$

Galilean transformation equations.

Transformation of velocity

$$\vec{V} = \frac{d\vec{r}}{dt} = \frac{d\vec{r'}}{dt} + v$$

$$\vec{V} = \vec{V'} + v$$

$$\vec{V'} = \vec{V} - v$$

$$\vec{V'_x} = \vec{V_x} - v$$

$$\vec{V'_y} = \vec{V_y}$$

$$\vec{V'_z} = \vec{V_z}$$

Acceleration $\vec{a'_x} = a_x$, $\vec{a'_y} = \vec{a_y}$, $\vec{a'_z} = \vec{a_z}$

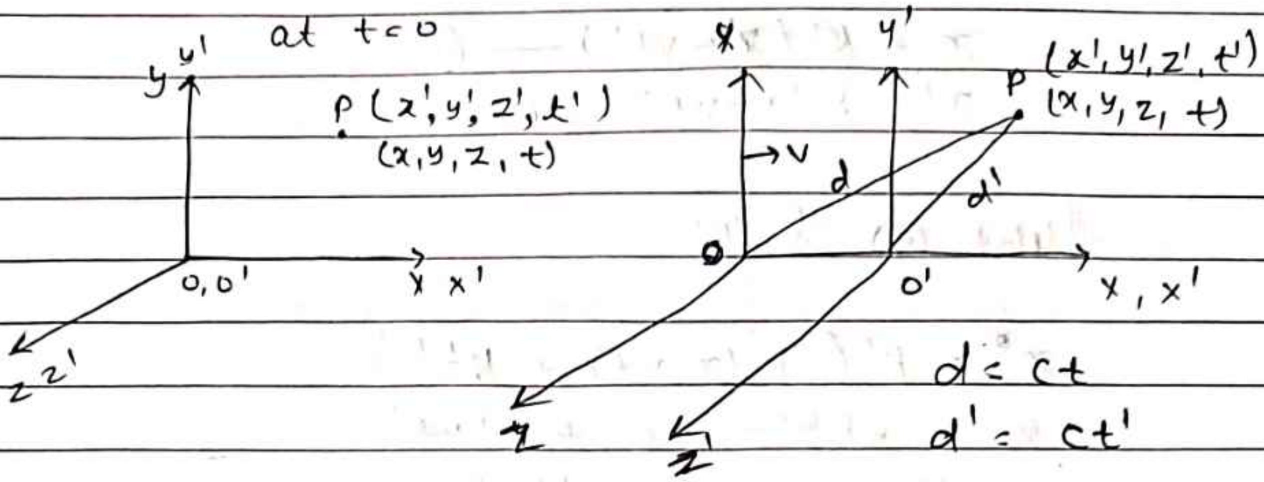
Postulates of Special theory of reletivity

(i) All physical law are the same in all inertial frames of reference which are moving with constant velocity relative to each other.

(ii) The speed of ligh in vacuum is same in every inertial frame.

Lorentz Transformation

Lorentz Transformation



The set of equations which relates the space time coordinates of two frame of references having relative motion b/w them

The eq. of sperical wavefront is given by

$$x^2 + y^2 + z^2 = d^2$$

$$x'^2 + y'^2 + z'^2 = d'^2$$

$$x^2 + y^2 + z^2 = c^2t^2 \quad \text{—— (i)}$$

$$x'^2 + y'^2 + z'^2 = c^2t'^2 \quad \text{—— (ii)}$$

$\because (y' = y , z' = z)$

(i) − (ii)

$$x^2 - x'^2 = c^2t^2 - c^2t'^2$$

$$x^2 - c^2t^2 = x'^2 - c^2t'^2 \quad \text{—— (iii)}$$

The relation between x & x'

$$x = K'(x' + vt') \text{ --- } (4)$$
$$x' = K(x - vt) \text{ --- } (5)$$

Using (4) & (5)

$$x = K'(K(x - vt) + vt')$$
$$x = KK'(x - vt) + K'vt'$$
$$x - KK'(x - vt) = K'vt'$$
$$t' = \frac{x}{K'v} - \frac{K(x - vt)}{v}$$
$$t' = \frac{x}{K'v} - \frac{Kx}{v} + Kt$$

$$t' = Kt - \frac{Kx}{v} + \frac{x}{K'v}$$
$$t' = Kt - \frac{x}{v}\left(K - \frac{1}{K'}\right)$$
$$t' = K\left[t - \frac{x}{v}\left(1 - \frac{1}{KK'}\right)\right] \text{ --- } (6)$$

Using 4, 5, 6, 3

$$x^2 - c^2t^2 = x'^2 - c^2t'^2$$
$$x^2 - c^2t^2 = [K(x - vt)]^2 - c^2\left[K^2\left\{t - \frac{x}{v}\left(1 - \frac{1}{KK'}\right)\right\}^2\right]$$

$$x^2\left[1-K^2+\frac{c^2K^2}{v^2}\left(1-\frac{1}{KK'}\right)^2\right]+2xt\left[K^2v-\frac{c^2K^2}{v}\left(1-\frac{1}{KK'}\right)\right]$$

$$-t^2\left(c^2+K^2v^2-c^2K^2\right)=0$$

Equating constant term zero

$$K=\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

Equating cofficient of $2xt=0$

$$K'=\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

~~Equating cofficient of x^2~~

By Putting K & K'

$$t'=\frac{t-\frac{xv}{c}}{\sqrt{1-\frac{v^2}{c^2}}}$$

Lorentz transformation equations.

$$x'=\frac{x-vt}{\sqrt{1-\frac{v^2}{c^2}}}$$

$y'=y$

$z'=z$

law of addition of velocities

$$u'_x = \frac{u_x - v}{1 - \frac{u_x v}{c^2}}$$

$$u'_y = \frac{u_y \sqrt{1 - v^2/c^2}}{1 - u_x v/c^2}$$

$$u'_z = \frac{u_z \sqrt{1 - v^2/c^2}}{1 - u_x v/c^2}$$

mass and length veriation with velocity

$$m = \frac{m_0}{\sqrt{1 - v^2/c^2}} \qquad l_0 = \frac{l}{\sqrt{1 - v^2/c^2}}$$

Mass Energy eq.

$$F = \frac{dP}{dt}$$

$$F = \frac{d}{dt}(mv)$$

$$F = m\frac{dv}{dt} + v\frac{dm}{dt}$$

$$F \cdot dx = m\frac{dx}{dt}dv + v\frac{dx}{dt}dm$$

$$dw = mv\,dv + v^2 dm$$

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$$dK = mv\,dv + v^2 dM \quad \text{—(1)} \qquad (dW = dK)$$

$$dK = \left(\frac{1}{2}mv^2 - \frac{1}{2}mu^2\right)$$

$$m = \frac{m_0}{\sqrt{1 - v^2/c^2}}$$

$$m_0 = m\sqrt{1 - v^2/c^2}$$

$$m_0^2 = m^2\left(1 - \frac{v^2}{c^2}\right)$$

$$m_0^2 c^2 = m^2(c^2 - v^2)$$

$$m_0^2 c^2 = m^2c^2 - m^2v^2$$

$$m^2c^2 - m^2v^2 = m_0^2 c^2$$

$$2m\,\underline{dm}\,c^2 - 2m\,dm\,v^2 - 2v\,dv\,m^2 = 0$$

$$2mc^2 dm - 2mv^2 dm - 2vm^2 dv = 0$$

$$c^2 dm - v^2 dm - \cancel{2}\,vm\,dv = 0$$

$$c^2 dm = v^2 dm + vm\,dv$$

$$\int_0^K dK = \int_{m_0}^{M} c^2 dm$$

$$K = c^2(m - m_0)$$

$$K = mc^2 - m_0c^2$$

TE = KE + PE ← rest mass energy

$$E = mc^2 - \cancel{m_0c^2} + \cancel{m_0c^2}$$

$$E = mc^2$$

$$E = mc^2$$

$$E = \frac{m_0 c^2}{\sqrt{1 - v^2/c^2}}$$

$$E\sqrt{1 - v^2/c^2} = m_0 c^2$$

$$E^2\left(1 - v^2/c^2\right) = m_0^2 c^4$$

$$E^2 - \frac{E^2 V^2}{c^2} = m_0^2 c^4$$

$$E^2 = m_0^2 c^4 + \frac{E^2 V^2}{c^2}$$

$$E^2 = m_0^2 C^4 + \frac{m^2 c^4 v^2}{c^2}$$

$$E^2 = m_0^2 c^4 + m^2 V^2 c^2$$

$$E^2 = m_0^2 c^4 + p^2 c^2$$

$$E = c\sqrt{m_0^2 c^2 + p^2}$$

Planck's Hypotheses

It is also called as planck's postulates is that energy is quantized and can only exist in discrete unit called "quanta" or "energy packets" or "photons" This hyphothesis was proposed by the German physicist max plank.

According to planck's hypothesis the energy of electromagnetic radiation is related to its frequency (ν) by the equation $E = h\nu$ where h is a fundamental planck's constant

Planck's radiation law →

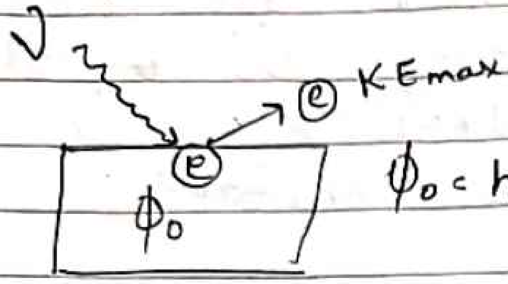
It is an important formula that describes ~~distribution~~ of Spectral distribution of electromagnetic ray emitted by a black body at a given temperature.

$$B(\nu, T) = \frac{2h\nu^3}{c^2} \frac{1}{e^{h\nu/KT} - 1}$$

This law describes how the energy of light is distributed at different wave lengths when it is emitted by a hot object called a black body.

The energy of light depends on wavelength and the temperature of the object. The law tells us how much energy is emitted at each wave length for a given temperature. It explains why object of different temperature emitt different colour of light.

Einstein's photoelectric equation →



$\phi_0 = h\nu_0$

ϕ_0 = work function

ν_0 = threshold frequency

$$h\nu = \phi_0 + KE_{max}$$ $\boxed{KE = qV}$

$$h\nu = h\nu_0 + eV_0$$

$$h\nu = h\nu_0 + \frac{1}{2}mv_{max}^2$$

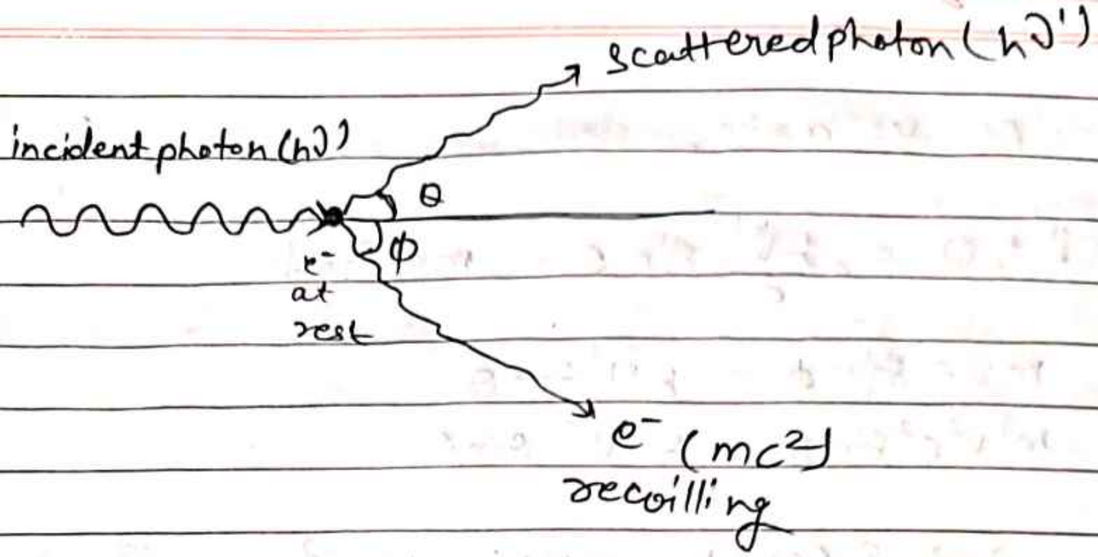
Compton effect :-

When a high frequency radiations are scattered by electrons of the scatterer, the frequency of the scattered wave is smaller than the frequency of incident radiation. This phenomenon is called compto effect. This effect proves the particle nature of electromegnetic waves.

The change in wavelength of high energy radiation during scattering process is called compton shift

$$\lambda' - \lambda = \Delta\lambda = \frac{h}{m_0 c}(1 - \cos\theta)$$

$P = \frac{h\nu}{c}$ momentum of photon



law of conservation

$$h\nu + m_0c^2 = h\nu' + mc^2$$
$$h(\nu - \nu') = c^2(m - m_0)$$
$$h(\nu - \nu') + m_0c^2 = mc^2 \quad \text{--- (1)}$$

Squate both side

$$h^2(\nu-\nu')^2 + m_0^2c^4 + 2h(\nu-\nu')m_0c^2 = m^2c^4$$
$$h^2\nu - h^2\nu'^2 - 2h^2\nu\nu' + m_0^2c^4 + 2h(\nu-\nu')m_0c^2 = m^2c^4 \quad \text{--- (2)}$$

law of conservation
x axis

$$\frac{h\nu}{c} + 0 = \frac{h\nu'}{c}\cos\theta + mv\cos\phi$$

$$h\nu - h\nu'\cos\theta = mvc\cos\phi \quad \text{--- (3)}$$

Square Both side.

$$m^2v^2c^2\cos^2\phi = h^2\nu^2 + h^2\nu'^2 - 2h^2\nu\nu'\cos\theta \quad \text{--- (4)}$$

At y-axis.

$$0 + 0 = \frac{h\nu'}{c}\sin\theta - mv\sin\phi$$

$$mvc\sin\phi = h\nu'\sin\theta$$

$$m^2v^2c^2\sin^2\phi = h^2\nu'^2\sin\theta$$

$$m^2v^2c^2(\sin^2\phi + \cos^2\phi) = h^2\nu^2 + h^2\nu'^2 - 2h^2\nu\nu'\cos\theta$$

$$m^2v^2c^2 = h^2\nu^2 + h^2\nu'^2 - 2h^2\nu\nu'\cos\theta \quad \text{--- (6)}$$

(6) − (2)

$$m^2c^2(c^2 - v^2) = -2h^2\nu\nu'(1-\cos\theta) + m_0^2c^4 + 2hm_0c^2(\nu-\nu') \quad \text{--- (7)}$$

As $m = \frac{m_0}{\sqrt{1 - v^2/c^2}}$ $\quad m^2 = \frac{c^2 m_0^2}{c^2 - v^2}$ --- (8)

(7) & (8)

$$\lambda' - \lambda = \Delta\lambda = \frac{h}{m_0c}(1-\cos\theta)$$

Uncertainty principle →

In clasical mechanics, one can find position & momentum of a moving object easily, if you are provided some initial conditions.

In quantum mechanics, the particle is described in terms of wave packet The partick is likely to found anywhere ~~withn~~ withing the wave packet moving with group velocity. Hence it is Impossible to know where the particle exactly is & what exactly is its momentum at any instant.

It states that "it is impossible to measure accurately & simultaneously both the position of a particle along a particular direction & momentum of a particle in same direction

if Δx = uncertainty in the measurement of ~~momentum in the same~~ position along x-direction

ΔP_x : uncertainty in the measurement of momentum in the same direction.

i.e. $\Delta x \cdot \Delta P_x \approx \hbar$

$$\Delta x \cdot \Delta P_x \approx \frac{h}{2\pi}$$

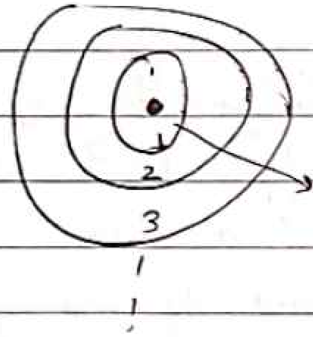
The relation given by equation (1) & (2) are known as "position momentum" "Uncertainty relation".

Heisenberg uncertainty relation is applicable to all those pairs whose product has dimensions of $M^1 L^2 T^{-1}$

i.e. $\Delta E \cdot \Delta t \approx \hbar$

& $\Delta J \cdot \Delta \theta \approx \hbar$

Ground states energy of H atom



$$\Delta x \cdot \Delta P \approx \frac{h}{2\pi}$$

if $\Delta x = r$

$\Delta P = P_{min} = P$

$$rP \approx \frac{h}{2\pi}$$

$$K = \frac{1}{2}mv^2 = \frac{P^2}{2m}$$

$$P = \frac{h}{2\pi r}$$

$$K = \frac{h^2}{2m \times 4\pi^2 r^2}$$

$$K = \frac{h^2}{8m\pi^2 r^2} \quad \text{—— (1)}$$

$$UE = \frac{-ke^2}{r}$$

$$TE = K + UE$$

$$= \frac{h^2}{8m\pi^2 r^2} - \frac{ke^2}{r}$$

$$TE = \frac{h^2}{8m\pi^2 r^2} - \frac{e^2}{4\pi\varepsilon_0 r}$$

$$\frac{d\,TE}{dr} = 0$$

$$\frac{d\,TE}{dr} = \frac{h^2}{8m\pi^2}\left(\frac{-2}{r^3}\right) + \frac{e^2}{4\pi\varepsilon_0 r^2}$$

$$= \frac{-h^2}{4m\pi^2 r^3} + \frac{e^2}{4\pi\varepsilon_0 r^2} = 0$$

$$\frac{e^2}{4\pi^2\varepsilon_0 \cancel{r^2}} = \frac{h^2}{4m\pi \cancel{r^3}}$$

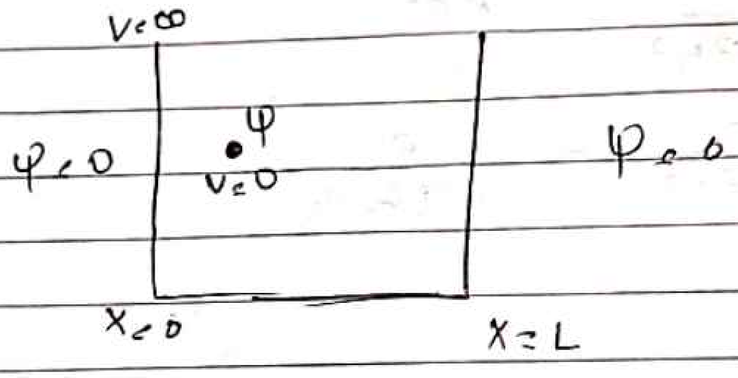
$$r = \frac{h^2\pi^2\varepsilon_0}{e^2 m\pi}$$

$$r = 0.53\ A^\circ$$

$$TE = \frac{\hbar^2}{2mr^2} - \frac{Ke^2}{r}$$

$$\boxed{TE = -13.6 \text{ eV}}$$

Schrodinger wave eq. for particle in 1D



$$\frac{d^2\psi}{dx^2} + \frac{8\pi^2 m}{h^2}(E-V)\psi = 0$$

$V = 0$

$$\frac{d^2\psi}{dx^2} + \frac{8\pi^2 m}{h^2}E\psi = 0$$

$$\because \frac{8\pi^2 mE}{h^2} = \lambda^2$$

$$\frac{d^2\psi}{dx^2} + \cancel{\frac{8\pi^2 m E}{h^2}} \cdot \lambda^2\psi = 0$$

$$\frac{d^2\psi}{dx} + \lambda^2\psi = 0 \quad \text{—— (ii)}$$

$$\psi = A \sin \lambda x + B \cos \lambda x$$

when $x = 0 \quad \psi = 0$

$x = L \quad \psi = 0$

$$B = 0$$

$$\psi = A \sin \lambda x$$

$x = L \quad \psi = 0$

$$0 = A \sin \lambda L$$

$A \neq 0$ then $\sin \lambda L = 0$

$$\lambda L = n\pi$$

$$\lambda = \frac{n}{L}\pi$$

$$\lambda^2 = \frac{n^2}{L^2}\pi^2 = \frac{8\pi^2 mE}{h^2}$$

$$\boxed{E = \frac{n^2 h^2}{8mL^2}}$$

$$\psi = A \sin \frac{n\pi}{L} x$$

Normalize wave $f x^n$

$$\int \psi^2 dx = 1$$

Probability of finding the particle in a wave is 100% that is called normalize wave fx^n

$$\int_0^L \psi^2 dx = 1$$

$$\int_0^L A^2 \sin^2 \frac{n}{L}\pi x \, dx = 1$$

$$A^2 = 2/L$$

$$A = \sqrt{\frac{2}{L}}$$

$$\left[\psi = \sqrt{\frac{2}{L}} \sin \frac{n}{L}\pi x \right]$$

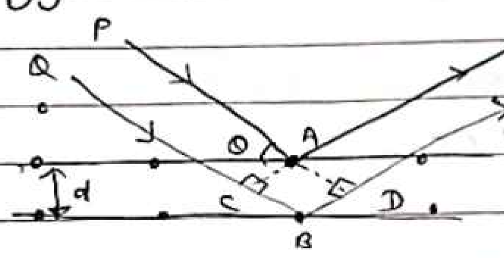
$$\psi^2 = \frac{2}{L} \sin \frac{n}{L} \pi x$$

Orthogality wave fx^n

$$\int \psi^2 dx = 0$$

when probability of finding particle is 0

Bragg's law



The reflected ray AR and BS will interfere contructive if the path difference CB & BD is equal to integral multiple of λ

i.e. $CB + BD = n\lambda$

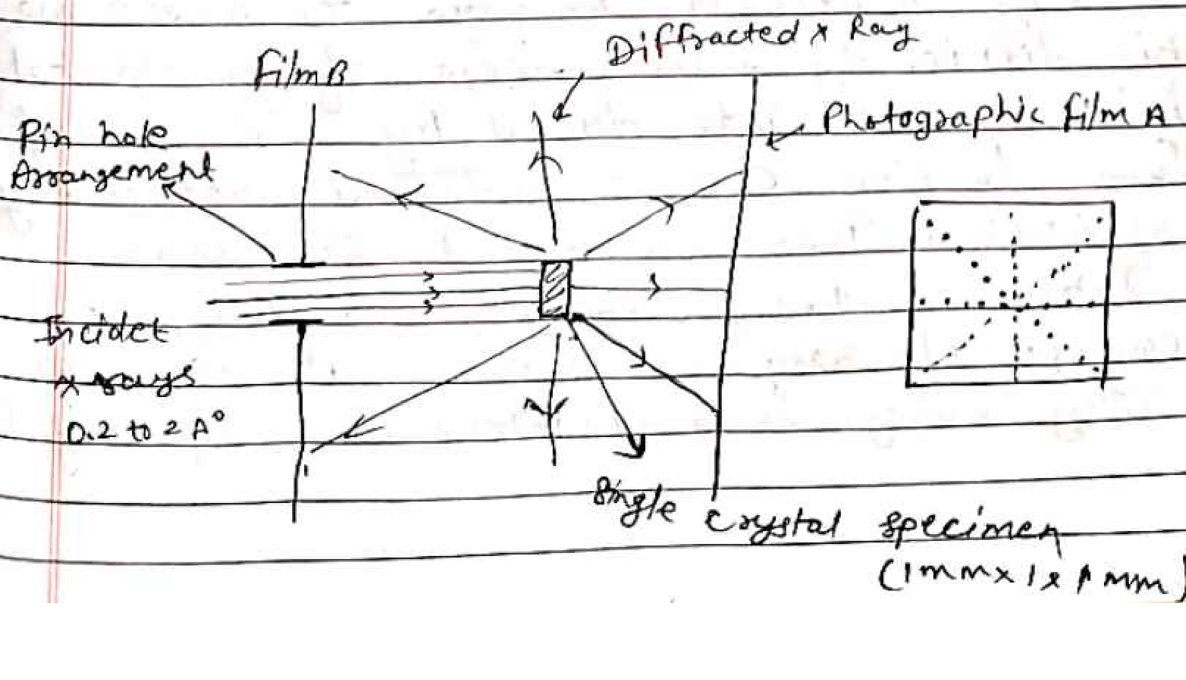
In ΔACB

$$\sin\theta = \frac{BC}{AB} = \frac{BC}{d}$$

$$BC = d\sin\theta = BD$$

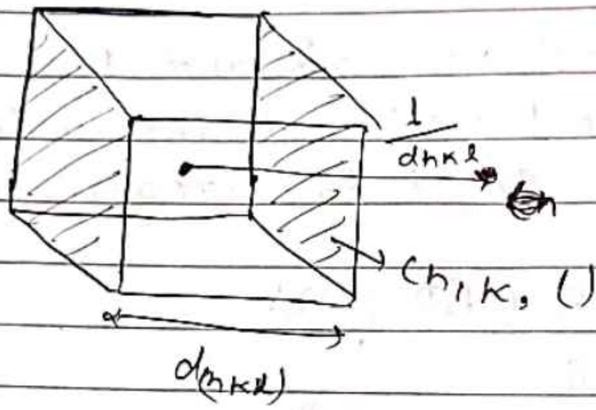
$$\boxed{2d\sin\theta = n\lambda}$$

Laue's method of x-Ray Diferaction



$$\frac{1}{d^2} = \frac{h^2}{a^2} + \frac{k^2}{b^2} + \frac{l^2}{c^2}$$

Reciprocal lattice



X ray diffraction is equivalent to reflection by the sets of parallel lattice planes in a crystal. But in a crystal there exists many sets of parallel planes with different orientations & interplaner spacings that can diffract given beam of X-ray. The visualization, of all these planes is very difficult ~~x-rays~~. To overcome this difficulty, the concept of reciprocal lattice was introduced by P.P. ewald Two lattice are associated with every crystal. These are direct or real lattice & Reciprocal lattice. Using the concept of resiprocal lattice it become very easy to find interplaner spacig (d)

To construct a reciprocal lattice

(i) Take a point in the direct lattice as origin.

(ii) From this origin, draw normal to every set of planes in the direct lattice

(iii) Set the length of each normal equal to reciprocal of interplaner spacing (d) for its particular set of parallel planes.

(iv) Place a point at the end of each normal.

The collection of points so obtained is called reciprocal lattice.

(1) Maxwell Boltzmann Statistics

(i) Particle are Distinguishable.
(ii) No Restriction.
(iii) Known as Maxwellons or boltzons.

A B . let 3 particle 3 levels

			C	B
C	A	B	B	C
AB	BC	AC	A	A

and ~~for~~ so on

let $N \to$ particle
$M \to$ Energy level

W = no. of ways $= M^N$

(2) Boze Einstein Statistics →

In distinguishable
No restriction
~~Ing~~ Intgral spin
Symetric wave fx^n
Bosons.

if total N
$n_1 \to E_1$ $n_3 \to E_3$
$n_2 \to E_2$ $n_4 \to E_4$

Cond^n (ii) $\omega = \frac{M!}{(M-N)!}$

$$\omega = \frac{N!}{n_1!\, n_2!\, n_3!\, n_4!}$$

(3) Fermi Dirac Statictics

Indistinguishable
Restriction ⟶ one particle → one Energy level
half integral spin
wave fx^n antisymmetric
fermions.

Case(1) N – particle M – Energy No restriction

$$\omega = M^N$$

Case(2) Only one can occupy one

$$\omega = \frac{M!}{(M-N)!}$$

Case(3) N particle

$n_1 \rightarrow E_1$
$n_2 \rightarrow E_2$
$n_3 \rightarrow E_3$

$$\omega = \frac{N!}{n_1!\, n_2!\, n_3!}$$

Bose einsten

$$\omega = \frac{(N+M-1)!}{N!\,(M-1)!}$$

(3) Fermi c dirac.

$$\omega = \frac{M!}{N!(M-N)!}$$

Lasers :-

It is a device that emits a collimated monochromatic, highly intense unidirectional beam of light. The full form of laser is Light Amplication due to Stimulated Emission of Radiations laser light is diffrent from ordinary light as it has following 4 special features.

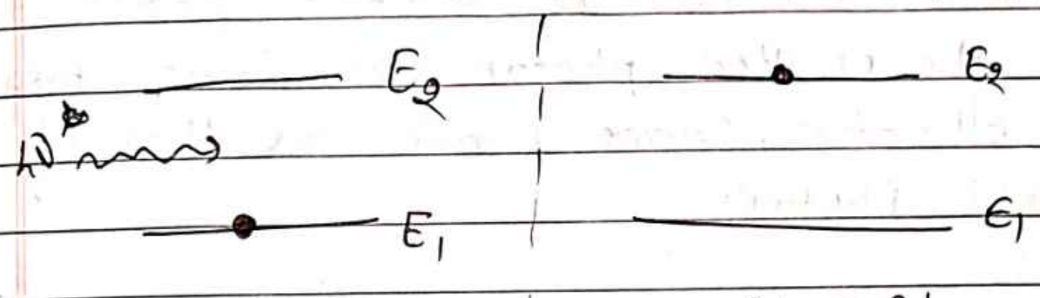
1) Monochromaticity :- Single Frequency & wave leng
2) Directionlity :- one paticular direction.
3) ~~Density~~ Intensity :- High intense
4) Coherence :- highly coherent

(1) Stimulated Absorption

Let us consider that initially an atom is in lower energy state having energy E_1. If a photon of energy $h\nu$ is incident on atom is lower state, then atom absorb this much amount of energy & jumps to upper state this energy E_2 such that

$h\nu = E_2 - E_1$ This process is known as induced absorption or stimulated absorption

$$A + h\nu \longrightarrow A^*$$

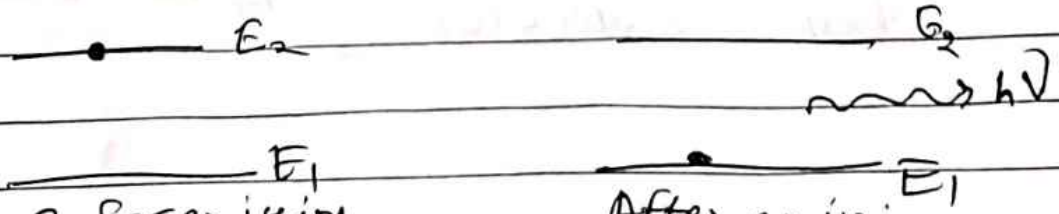


Before Absorption After Absorption

(2) Spontaneous Emission

Consider that initially an atom is in higher energy state E_2 since normal life time of atom in excited state is 10^{-8} sec, so atom will make a transistion to lower energy state E_1. During this transition, atom will release a photon of energy $h\nu$ where $h\nu = E_2 - E_1$. This emission is known as spontaneous emission.

Thus we can say that emission of ~~p~~ a photon by an atom without any external energy is known as spontaneous emission. $A^* \longrightarrow A + h\nu$

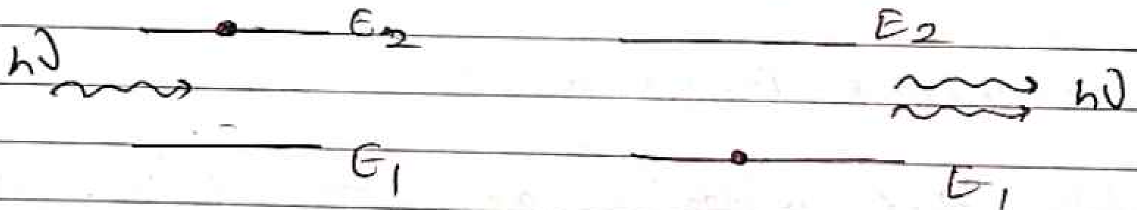


Befor emission After emission.

(3) Stimulated emission →

As suggested by Einstein is 1917 an atom in exited state E_2 can also ~~b~~ make transiti to lower energy state E_1 when triggered by photon of energy $h\nu$ During this transition, emission of second photo take place the emitted photon has same frequency same direction, same phase as that of incident photon

$$A^* + h\nu \longrightarrow A + 2h\nu$$



Einstein's Cofficients

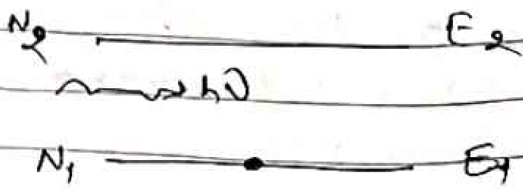
(1) Stimulated absorption (B_{12})

$E(\nu)$ = energy density of incident Ray

Rate of Stimulated Absorption R_{StA} is

$R_{StA} \propto N_1$

$R_{StA} \propto E(\nu)$



$$R_{StA} = B_{12} N_1 E(\nu)$$

(2) Spontaneous Emission (A_{21})

$$R_{spE} \propto N_2$$
$$R_{spE} = A_{21} N_2$$

(3) Stimulated emission (B_{21})

$$R_{stE} \propto N_2$$
$$R_{stE} \propto E(\nu)$$
$$R_{stE} = B_{21} N_2 E(\nu)$$

At Thermodynamic equilibrium

$$R_{stA} = R_{spE} + R_{stE}$$
$$B_{12} N_1 E(\nu) = A_{21} N_2 + B_{21} N_2 E(\nu)$$

$$E(\nu) = \frac{A_{21} N_2}{(B_{12} N_1 - B_{21} N_2)}$$

$$= \frac{A_{21} N_2}{B_{21} N_2 \left(\frac{B_{12} N_1}{B_{21} N_2} - 1\right)}$$

$$E(\nu) = \frac{A_{21}}{B_{21}\left(\frac{B_{12} N_1}{B_{21} N_2} - 1\right)}$$

According to Maxwell boltzmann distribution.

$$\frac{N_1}{N_2} = e^{(E_2 - E_1)/K_B T}$$

$$\frac{N_1}{N_2} = e^{h\nu/K_B T}$$

$$E(\nu) = \frac{A_{21}}{B_{21}} \frac{1}{\left[\frac{B_{12}}{B_{21}} e^{h\nu/K_BT} - 1\right]}$$

According to plank's Radiation law

$$E(\nu) = \frac{8\pi h\nu^3}{c^3} \frac{1}{\left[e^{h\nu/K_BT} - 1\right]}$$

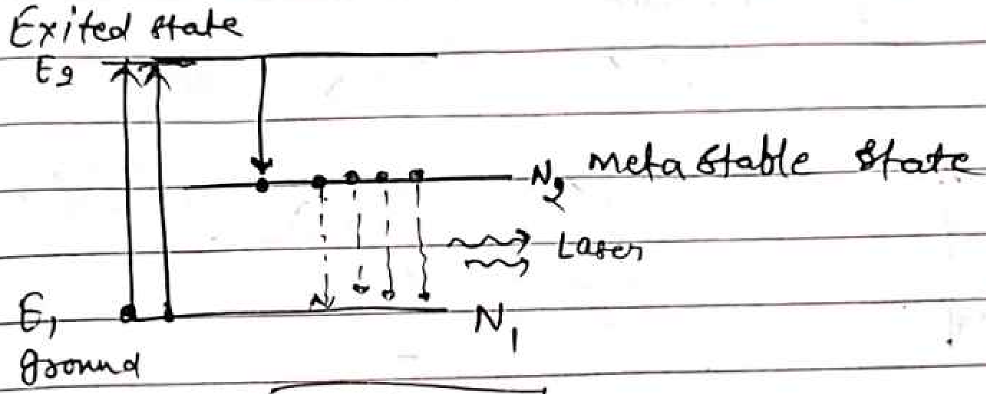
$$\frac{A_{21}}{B_{21}} = \frac{8\pi h\nu^3}{c^3}$$

$$\frac{B_{12}}{B_{21}} = 1$$

$$B_{12} = B_{21}$$

Population inversion

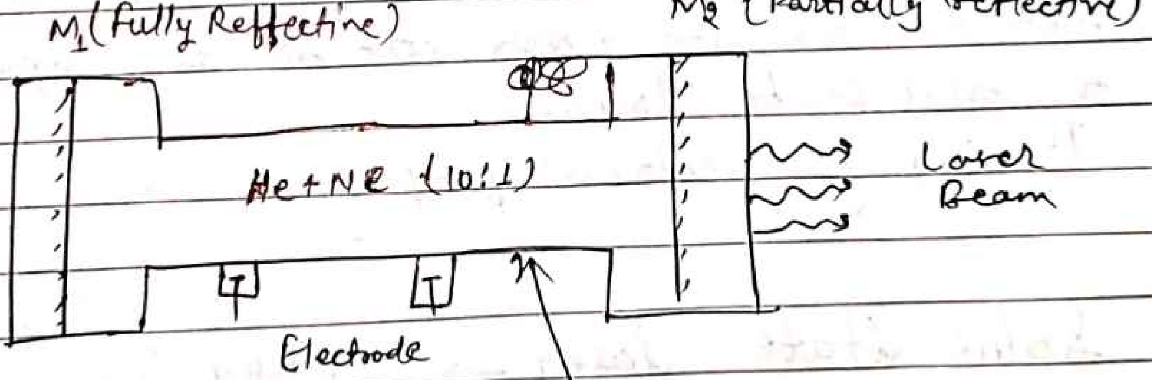
It is a condition where most particles is a system are in higher energy levels rather that lower energy levels. Normally particles tend to occupy lower energy levels because that's their natural state. But under certain circumstances, such as in lasers or electronic devices, scientists can make more particles occupy higher energy levels than lower ones this reversal of the usual distribution is called population inversion



$$\boxed{N_2 > N_1}$$

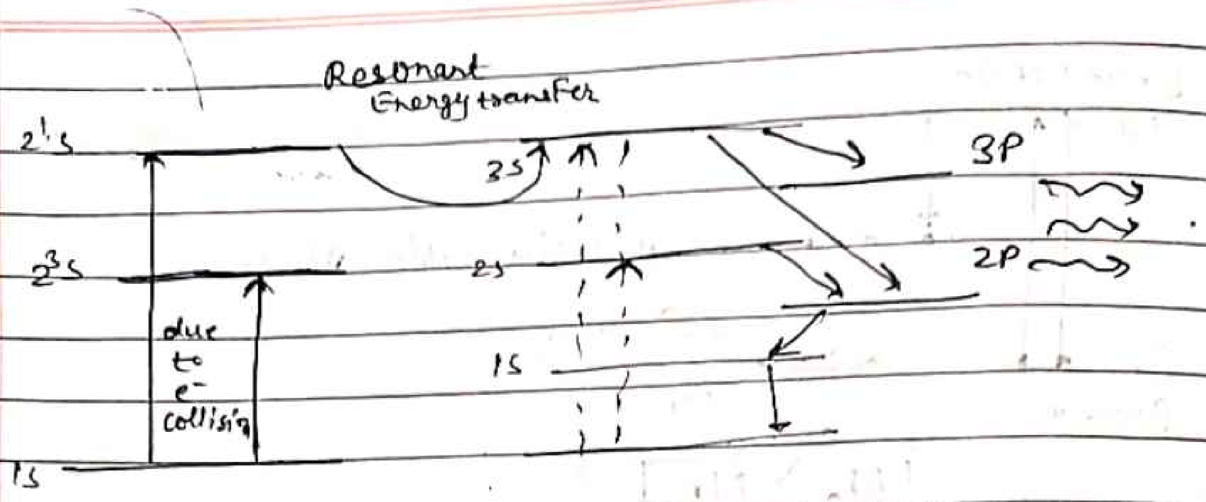
He - Ne Laser →

It is the first gas laser to be operated sucessfully & was fabricated by Ali - Javan.



He at 1 mm of Hg
Ne at 0.1 mm of Hg

Narrow discharge tube
(25 - 100 cm length
1 cm Diameter.)



G.S. He

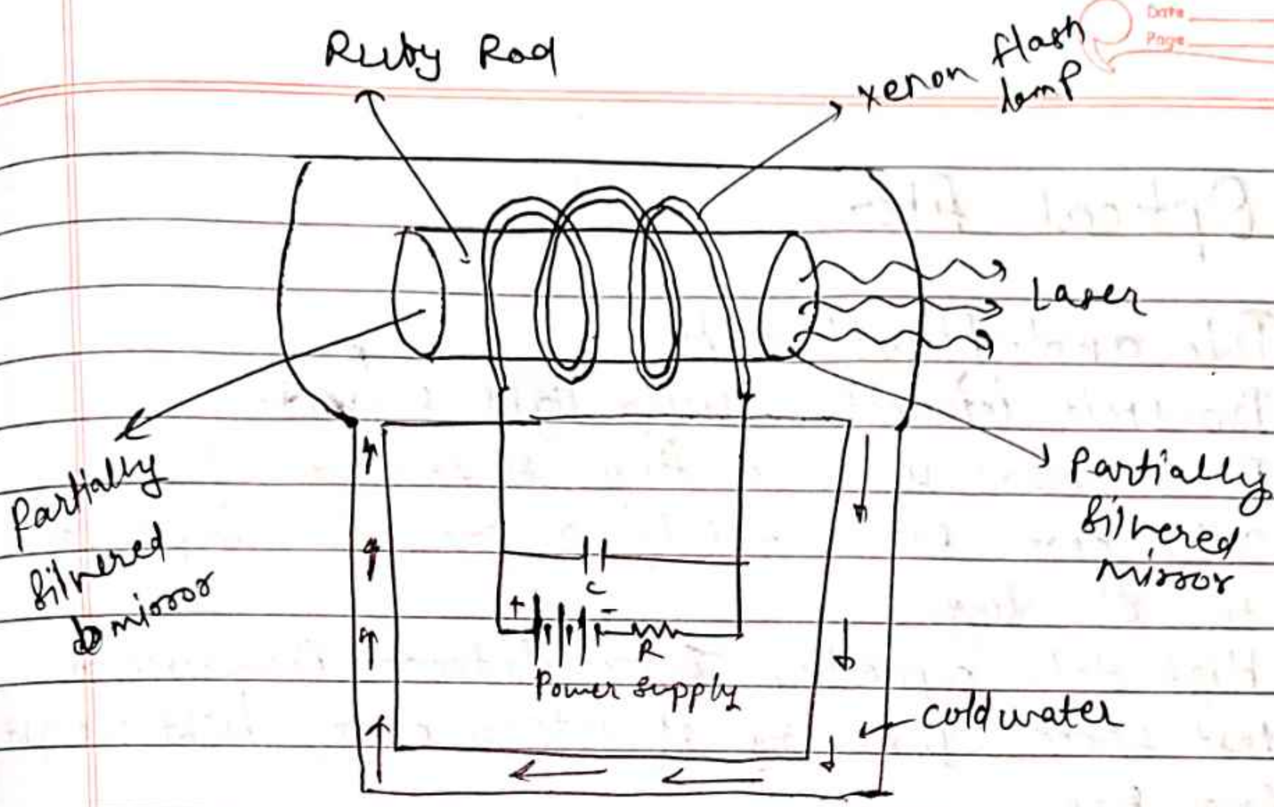
$$He + e^- \longrightarrow He^*$$

$$He^* + Ne \longrightarrow Ne^* + He$$

(1) It is 4 level laser
(2) It is easy to construct & reliable in operation
(3) It works in continuous mode.
(4) It does not require cooling apparatus
(5) The light from He-Ne laser is more directional more monochromatic, more coherent as compared to Solid state lasers.
(6) It employs electrical pumping.

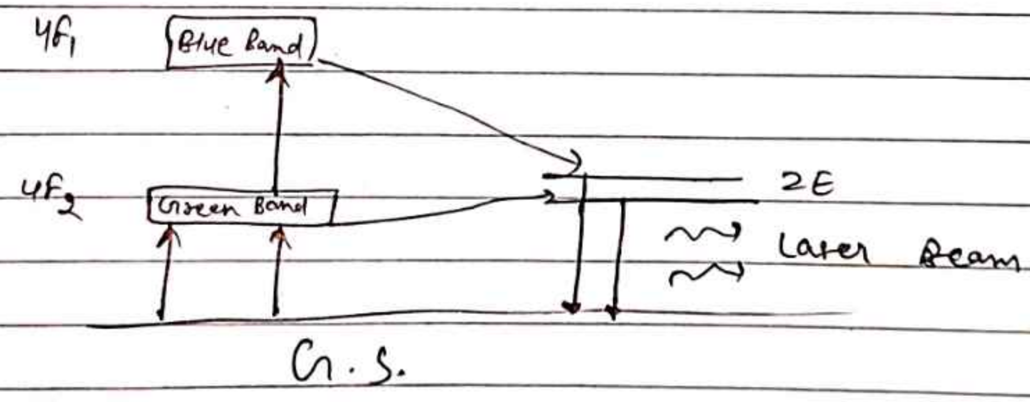
Solid State laser → Ruby laser

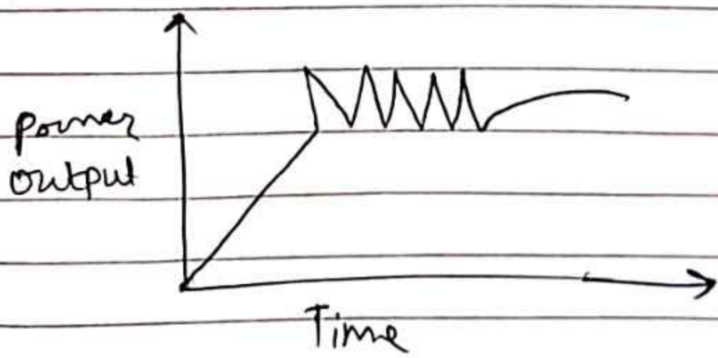
(i) It is Solid State laser
(ii) It is 3 level laser
(iii) It employs optical pumping
(iv) It works in pulse mode.



Ruby Rod

$Al_2O_3 + Co_2O_3$





Optical fiber

Thin and flexible cable
Transmit information using light signals
It is made up of a tiny strand glass of plastic called core surrounded by a protective layer called the cladding
High data capacity, long distance Transmission, fast speed, Immunity of interference, Light weight small size

← GM Counter →

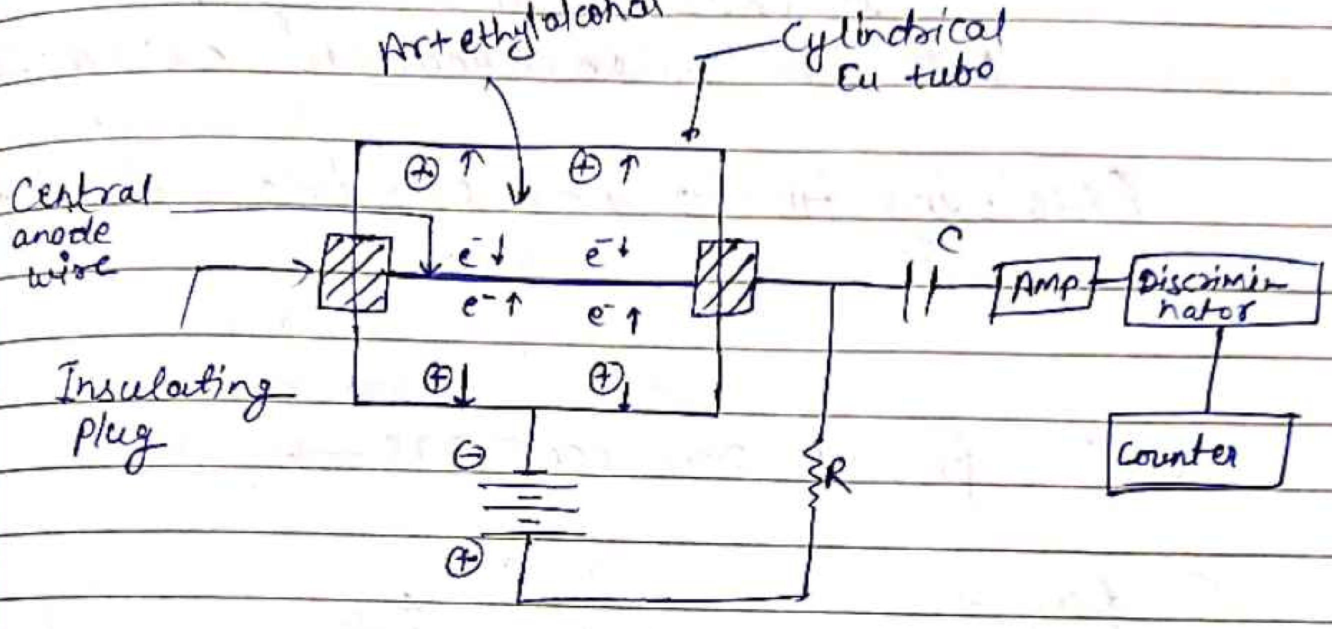
It is a type of gas filled detector which is used to measure inonising radiations or charged particls like α, β particles.

Principle :- In GM counter the applied voltage exceed a limit so that the ~~detection~~ detector operates in the GM region (Region V) then charge collected is no longer proportional to the initial ~~con~~ ~~constation~~ ionisation. The gas multiplication factor m is very large in this region. A single ion pair produced by radiation entering the chamber can produce an electric discharge inside the chamber

When a charge particle passing through a gas, ionizes it. The ion pair so produced during ionization get accelerated under a high PD & produced further ionization.

This ionization is called secondary or indirect ionization & ultimately a large no. of ion produced.

Construction:-



Quenching → The process of removal of sheath of positive ions is called Quenching.

External Quenching → Connect high resistance parral to cu tube.

Internal quenching → Mix ethyl alcholon with Ar gas.

Dead time → ⊕ heavey → slow move to cathode
⊖ light → fast move to anode

Jab ⊕ chathode tk nahi pahuchte GM active nhi hoge

The time in which GM counter remains completely insensetive.

Recovery time → The time in which counter becomes ready to produce Full size pulse again is called —

Resolving time = Recovery time + dead time

α, β, γ radiations →

α Ray →

(1) It is represented as ${}_{2}^{4}He$
(2) It caries ~~2~~ $+2$ charge & 4 unit mass
(3) Ionizing power is high
(4) Penetrating power is low
(5) Velocity is 2×10^{9} cm/sec.
(6) Range is very small i.e 8.12 cm
(7) On emission of α-particle atomic no. decrease by 2 unit & ~~an~~ atomic mass decreases by 4 unit

β rays

(1) It is represented as ${}_{-1}e^{0}$
(2) It carries 1 negative charge and negligible masses
(3) Ionizing power is less than α rays
(4) Penetrating power is ~~to~~ 100 time more than α rays
(5) Velocity is 3×10^{10} cm/sec $\approx C$
(6) Range is very small i.e. 8.12 cm
(7) Increase 1 ~~uo~~ unit atomic no. 0 atomic mass

γ rays

(1) It is represented as $_0^1n$

(2) They are electromagnatic wave with short wave length.

(3) Ionizing power is less than α, β

(4) Penetrating power is 100 times more the β rays

(5) velocity = c

(6) Range is small 8.12 cm

(7) no change