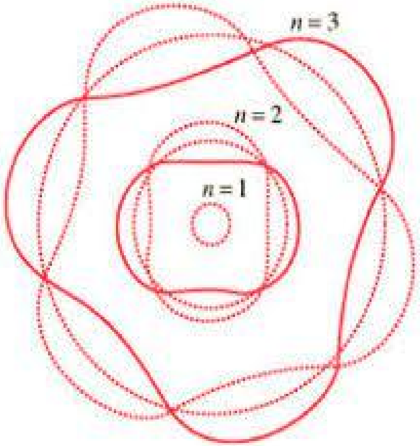
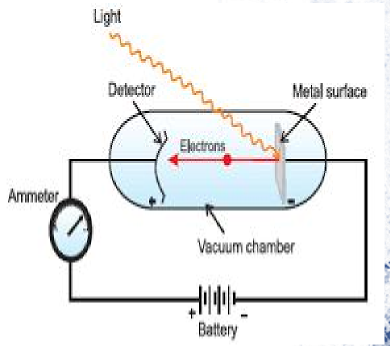


Elementary Quantum Mechanics



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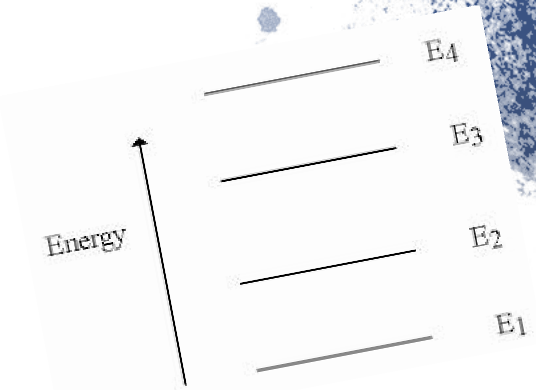
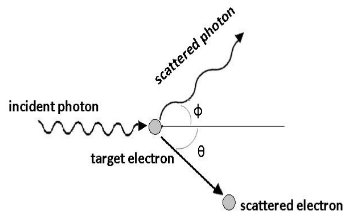
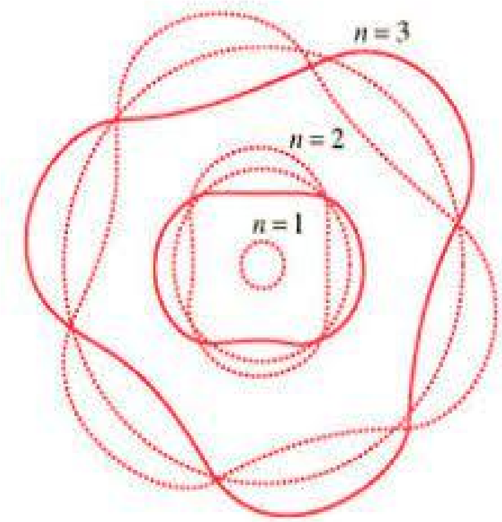
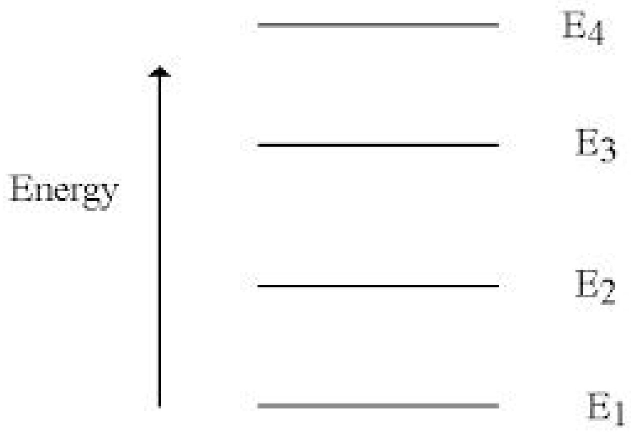


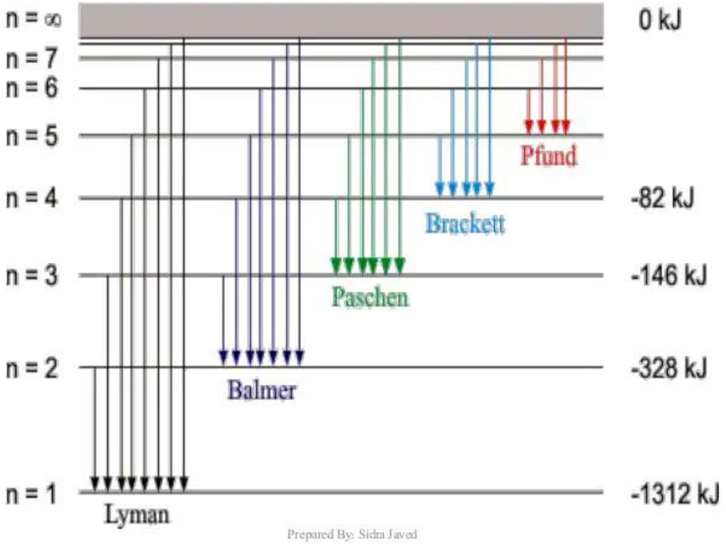


Elementary Quantum Mechanics

Why we study Elementary Quantum Mechanics

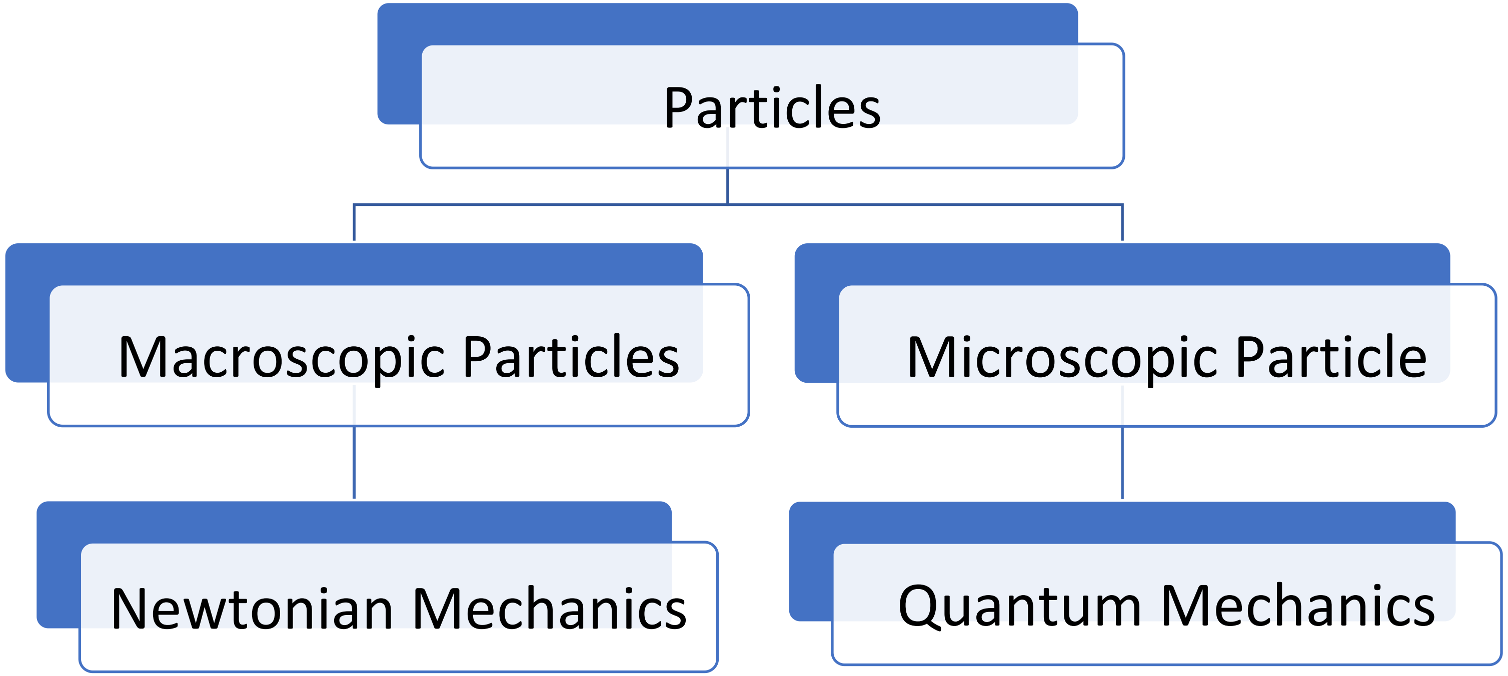






- Origin of quantum numbers
- Quantization of energy level
- Hydrogen atom Spectra.
- Describe nature at microscopic nature

INTRODUCTION



- Elementary: associated with microscopic particles
- Quantum: bundle or packet of energy
- Mechanics: study of particle in motion

Drawbacks of Elementary Quantum Mechanics

- Black Body Radiation
- Photoelectric effect
- Heat Capacities of Solids
- Initial atomic models

Planck's Quantum Theory

- To explain black body radiation
- Discontinuous emission or absorption of light
- Quanta: Packets or bundle of energy

Quanta: Max Planck

Photon: Albert Einstein

- $E \propto \vartheta$

E-energy associated with a quantum

ϑ- frequency of radiation

$$E = h\vartheta = \frac{hc}{\lambda} = hc\overline{\vartheta}$$

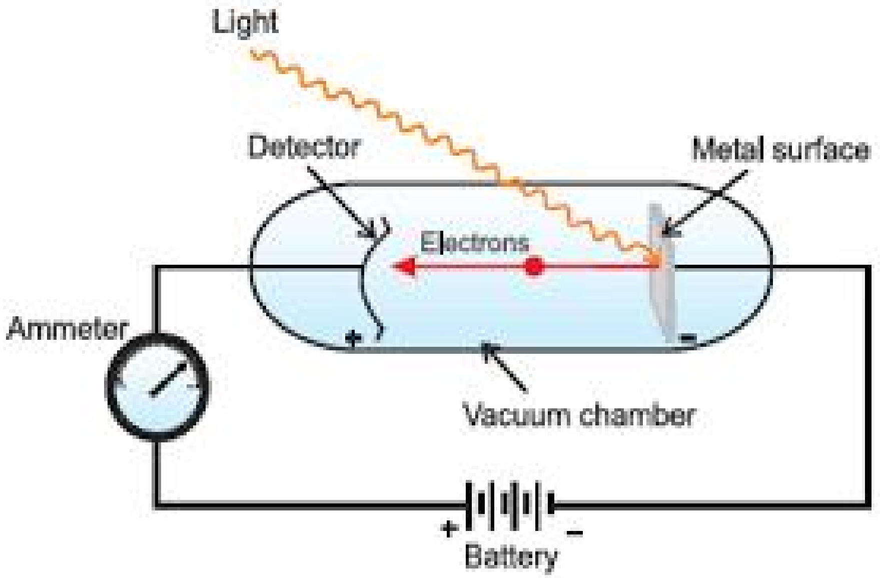
- The total amount of energy emitted or absorbed by a body will be some whole number multiple of quantum.

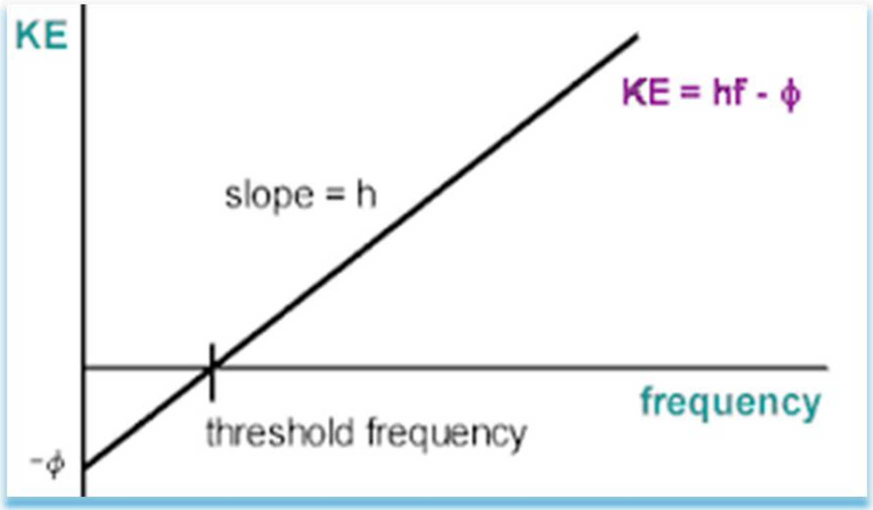
$$E = Nh\vartheta$$

Quantization of energy level

Photoelectric effect

- Photoelectric effect
- Photoelectron
- Threshold frequency ϑ_0
- Work function $\emptyset = h\vartheta$
- K.E. of photoelectron ∝ frequency of incident photon (ϑ)
- Number of photoelectron ejected ∝ intensity of incident photon
- $K.E. = h\vartheta - \emptyset$





Compton's ef,fect

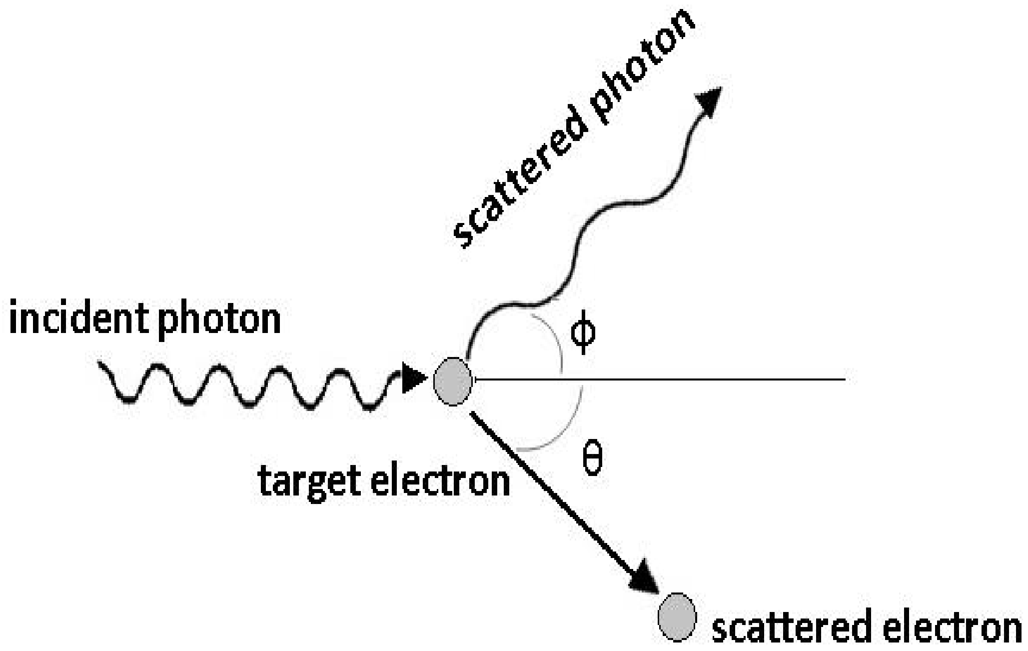
- Compton's effect
- Angle of scattering
- $\lambda_{scattered} > \lambda_{incident}$
- Compton's Shift $\Delta\lambda = \lambda_{scattered} - \lambda_{incident}$

$$\Delta\lambda = \frac{2h}{mc} sin^2 \left\{\frac{\theta}{2}\right\} = \frac{h}{mc}(1 - \cos\theta)$$

i) If $\theta = 0^o$, $\Delta\lambda = 0$

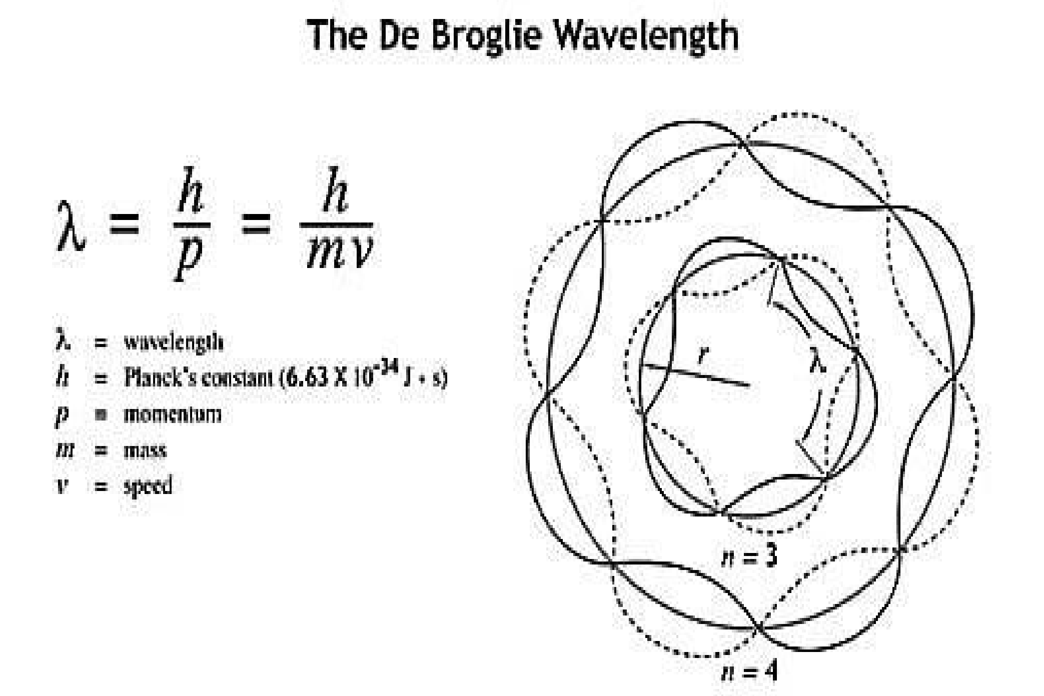
ii) If $\theta = 90^o$, $\Delta\lambda = 2.42\ pm$

iii) If $\theta = 180^o$, $\Delta\lambda = 4.84\ pm$



de Broglie hypothesis

- Explain wave particle duality
- Wave Nature: diffraction and interference
- Particle nature: photoelectric effect and Compton's effect
- $\lambda \propto \frac{1}{m}$



Heisenberg's uncertainty Principle

- Supports de Broglie's hypothesis
- Relation between uncertainty in position and momentum of microscopic particle
- $\Delta x.\Delta p \geq \frac{h}{4\pi}$
- $\Delta x.\Delta v \geq \frac{h}{4\pi m}$
- $\Delta E.\Delta t \geq \frac{h}{4\pi}$


Thank You !