Wave mechanics or Wave Mechanical model of an atom
Modern Concept of structure of Atom or Quantum Mechanical model

This model consists of following

(i) de-Broglie concept (Dual nature of matter)
(ii) Heisenberg's Uncertainty principle.

(i) **Dual nature of matter** or (Particle and wave nature of electron) :→

French physicist, Louis de-Broglie — In 1924

de-Broglie proposed that an electron, like light, X-rays behaves both as a material particle and as a wave. This proposal gave birth to a new theory known as wave mechanical theory of matter.

A/c to this theory →

The electrons, protons and even atoms, when in motion, possess wave properties. i.e. The wavelength (λ) of an electron is inversely proportional to its momentum (p)

$$\boxed{\lambda \propto \frac{1}{p}}$$

A/c to Planck's eqn,

$$\boxed{E = h\nu = h \cdot \frac{c}{\lambda}} \quad \text{——— (i)}$$

The energy of a photon on the basis of Einstein's mass-energy relationship is

$$\boxed{E = mc^2} \quad \text{——— (ii)}$$

Where, c = velocity of electron

Equating both the eqn, we get

$$h\frac{c}{\lambda} = mc^2$$

$$\lambda = \frac{h}{mc} = \frac{h}{p}$$

$$\boxed{\lambda = \frac{h}{p}}$$

where, h = Planck's const
& p = momentum of electron
λ = wave length

Let kinetic energy of the particle of mass 'm' is E. then,

$$E = \frac{1}{2}mv^2$$

$$\Rightarrow 2Em = m^2v^2$$

$$\Rightarrow \sqrt{2Em} = mv = p \text{ (momentum)}$$

$$\Rightarrow \lambda = \frac{h}{p} = \frac{h}{\sqrt{2Em}}$$

Davisson and Germer made the following modification in de-Broglie equation.

Let a charged particle say an electron be accelerated with a potential of V; then the kinetic energy may be given as:

$$\frac{1}{2}mv^2 = eV$$

$$m^2v^2 = 2eVm$$

$$mv = \sqrt{2eVm} = p$$

$$\boxed{\lambda = \frac{h}{\sqrt{2eVm}}}$$