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MJC Physics / Unit-1

Need of quantum mechanics \rightarrow The Old Quantum theory has explained some of the phenomena like photoelectric effect, Compton effect, blackbody spectrum, emission of spectral lines etc. The difficulty with quantum theory was how to explain the optical effects, i.e. phenomena like interference, diffraction etc. which are exhibited by the very same light. For this Einstein suggested the light waves merely serves as 'guide' for photons, each carrying energy ~~$h\nu$~~ $h\nu$. This idea was difficult to ~~accept~~ accept at that time because particle nature ^{and} wave nature are apparently different for the reason the particle has a definite mass, velocity, momentum etc. in the space while a wave is associated with wave-length, frequency, phase, amplitude intensity, etc.

To resolve this this Victor de Broglie, in 1924 suggested the duality of matter for which he was awarded Nobel prize in 1929. He proposed that the matter ~~has~~ possess 'wave' as well as 'particle'

Characteristics. The motion of electrons in atom is guided by peculiar kind of wave similar to the electromagnetic waves, which serves to guide photons. According to him, electrons as well as protons which ordinarily behave like particle, under certain conditions behave like a train of waves. The wavelength of these wave depends upon the momentum which in turn depends upon the mass and velocity of the particles. This idea was ~~immediately~~ immediately accepted and later ~~it~~ it was extended by Heisenberg, Schrodinger, Dirac, Max Born, and others. This led to the foundation of new branch called 'wave mechanics' or New Quantum Mechanics.