ATOMS

DE BROGLIE'S EXPLANATION OF BOHR'S SECOND POSTULATE OF QUANTISATION

SECOND POSTULATE

In Bohr's investigation of the atom, he observed that the orbital angular momentum of an electron, while orbiting the nucleus, is constrained to specific values. This limitation of the orbital angular momentum is referred to as quantization. Bohr incorporated this observation as his second postulate in the atomic model. The second postulate states: "During the revolution around the nucleus, the orbital angular momentum of the electron, denoted as L, is not arbitrary; instead, it can only assume values that are integral multiples of Planck's constant divided by 2π, represented as h/2π.

Hence, the angular momentum of an electron can be expressed as:

$$L = \frac{nh}{2\pi} \qquad \ldots (1)$$

In an orbit with a radius denoted as "r," if an electron (with mass "m") revolves at a speed "v," the angular momentum can be expressed as:

$$L = mvr \qquad \ldots (2)$$

Now, considering equations (1) and (2), we can express the angular momentum for a revolving electron as follows:

$$mvr = \frac{nh}{2\pi} \qquad \ldots (3)$$

Equation (3) represents the formulation of the second postulate in Bohr's model. Notably, the quantity $\frac{h}{2\pi}$ appears so frequently in modern physics that, for convenience, it is designated as $\hbar$, pronounced as "h-bar."

$$h = \frac{h}{2\pi} \simeq 1.055 \times 10^{-34} \ j - s \qquad \ldots (4)$$