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Davisson and Germer's Experiment

INTRODUCTION

- Proved - wave nature of electrons and verified the de Broglie equation.
- Before 1924 - De Broglie argued the dual nature of matter - later that Davisson and Germer's experiment verified the results.
- First experimental proof of quantum mechanics.
- Study the scattering of electrons by a Ni crystal.

PURPOSE

- Measuring the energies of electrons scattered from a metal surface.

- Electrons from a heated filament were accelerated by a voltage and allowed to strike the surface of nickel metal.

PRINCIPLE

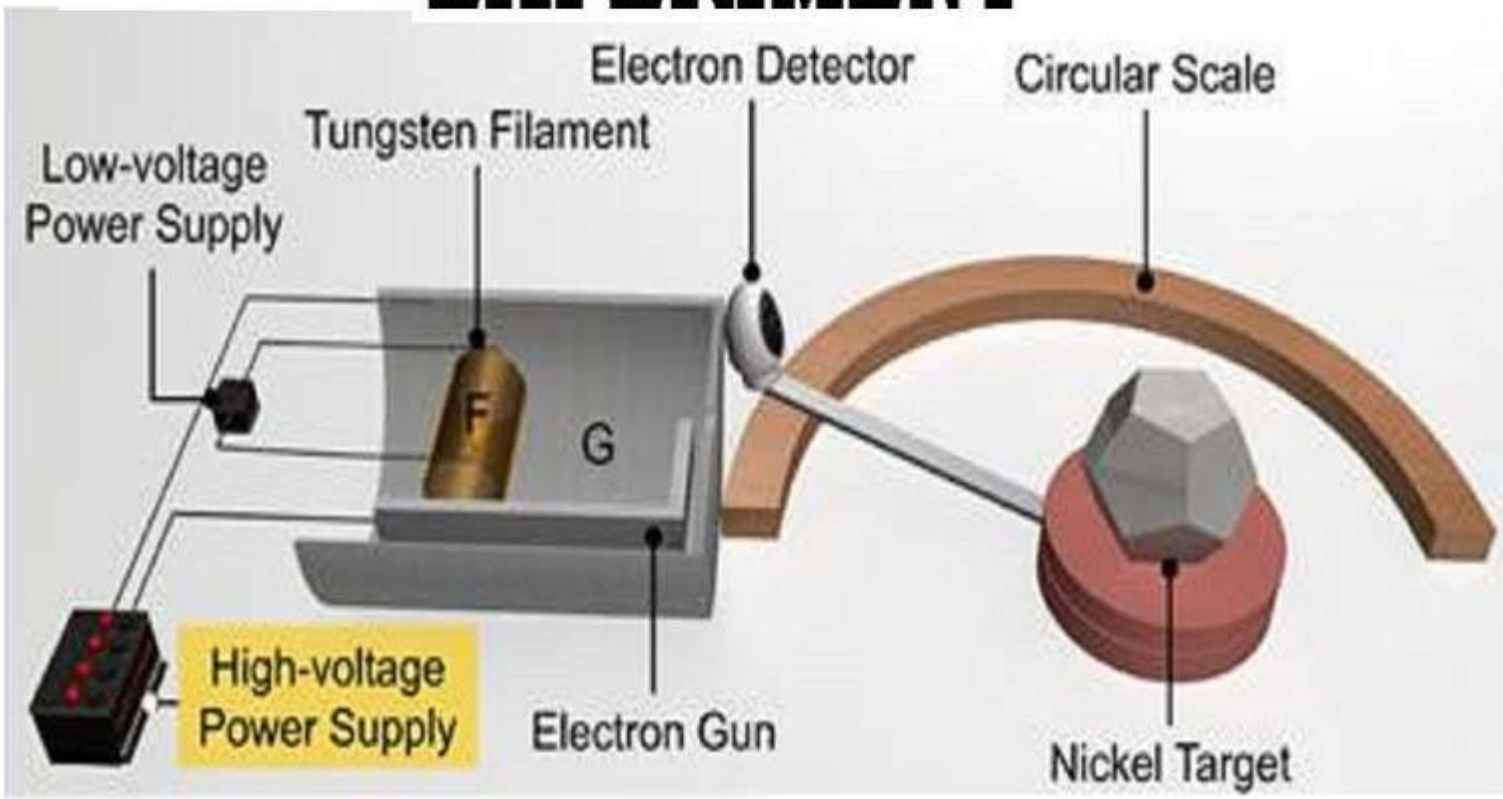
- De-Broglie hypothesis - electron beams get diffracted when scattered by a crystal.

- Davisson and Germer's experiment - electrons emerge out of a hole in the form of a fine beam - made to fall on a nickel crystal.

WORKING

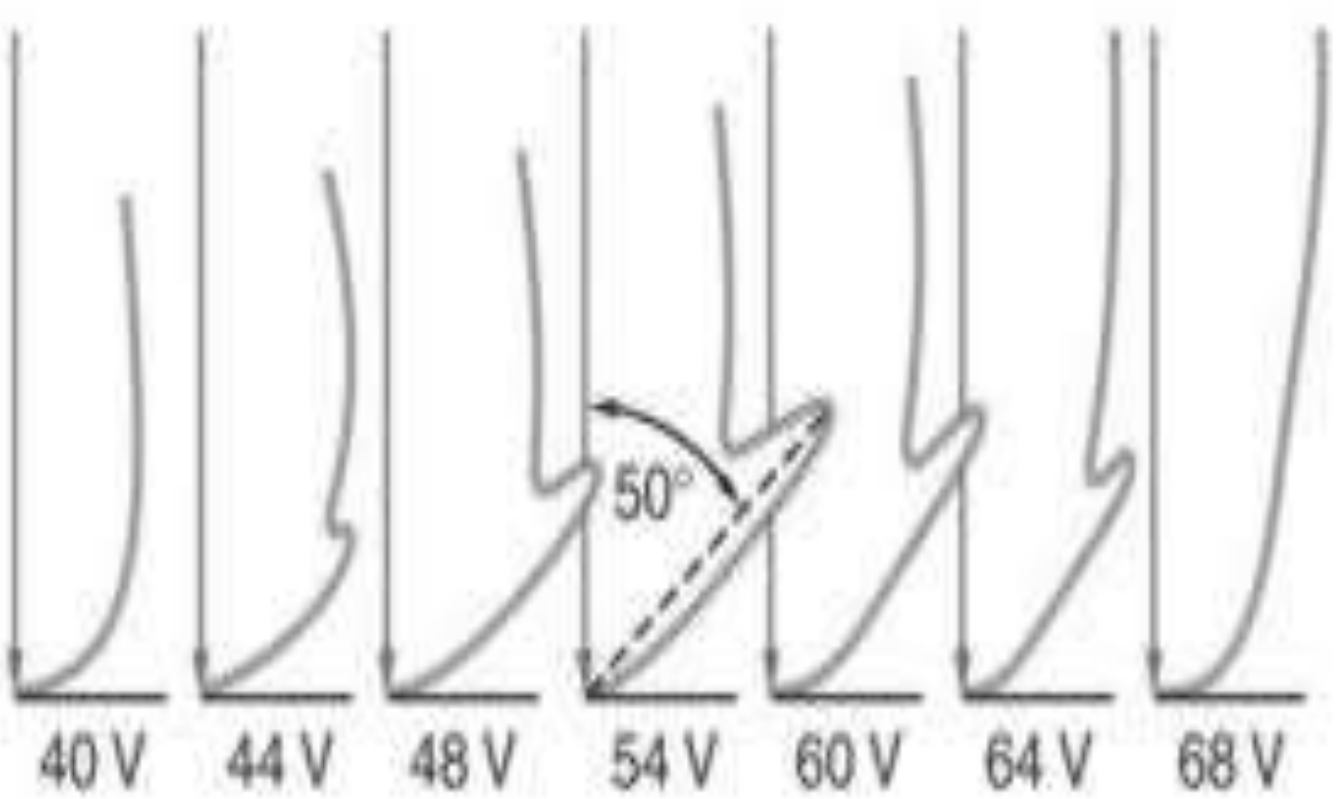
- Electrons - produced by heating a filament (F) by a low tension battery (L.T).
- Electrons - then accelerated through a potential difference V in the electron gun.
- Electron beam falls on - large single crystal of nickel.
- Electrons - scattered in all directions by the atom in the crystal.
- Detector - moved to any angle - to the incident beam.
- Energy of the electrons in the primary beam, the angle at which they reach the target and the position of the detector could be varied.

DAVISSON & GERMER EXPERIMENT



EXPERIMENTAL PROCEDURE

- Accelerating potential V is given a low value.
- The beam of electrons falls - on the surface of the crystal.
- Detector is moved to various positions and the intensity of the diffracted beam.
- The graph - plotted against the angle between the incident beam and the beam entering the detector.
- The intensity at any angle is proportional to the distance of the curve - angle from the point of scattering.
- The observations are repeated for different accelerating voltages and a number of curves.


50°
40 V
44 V
48 V
54 V
60 V
64 V
68 V

- The graph remains fairly smooth - accelerating voltages becomes 44V when a 'bump' appears on the curve.
- Accelerating voltage is increased, the length of the 'bump' increase.
- The bump becomes most prominent in the curve for 54 v at 50º.
- Accelerating voltage is further increased, the bump decrease in length and finally disappears at 68V.

CONCLUSION

- Davisson and Germer's experiment proves - De Broglie's hypothesis - by proving - wavelength λ for an electron at 54V is 0.167nm theoretically and practically as well.

THANK YOU