UNIVERSITY OF BIRMINGHAM

Lecture 9 – Wave functions for Quantum Particles

Recap of Lecture 8

- Wave-particle duality – interference, but also single-particle detections
- Waviness gives quantisation of energy in a bound system eg potential well
- Energy levels depend on the 'shape' of the potential
- Heisenberg Uncertainty Principle $\Delta p_x \, \Delta x \geq h/4\text{p}$– the better we know momentum, the worse we know position

In this lecture

- Reminder of the classical wave equation – building to the (complex) quantum mechanical version
- The idea of probability density and probability amplitude
- Standing waves and the particle-in-the-box as a wave

Probability interpretation

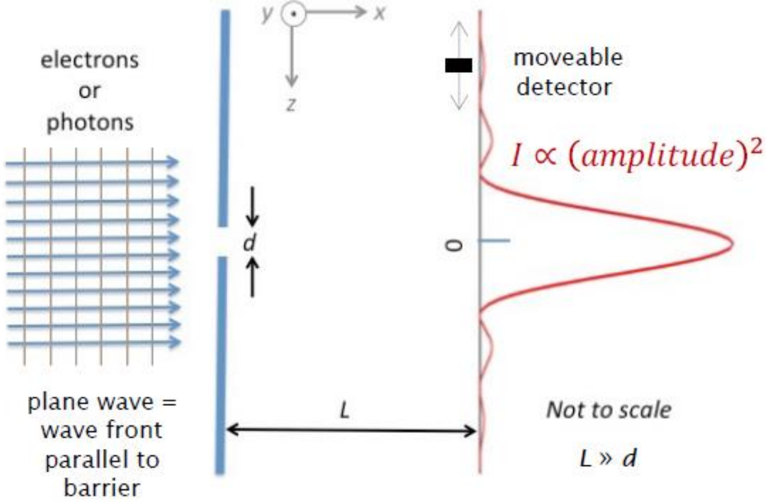
Max Born
(1882-1970)

- The probability interpretation of the QM wave function was proposed by Max Born in a paper entitled “Zur Quantenmechanik” in 1926

- This is the first time that the term *Quantum Mechanics* appears in the scientific literature.

- Max Born shared the 1954 Nobel Prize with Walther Bothe for the development of QM

Probability density as Intensity



Standing Waves