UNIVERSITY OF
BIRMINGHAM

Lecture 1 – Atomic Structure
Lecture 2 – The Ultraviolet Catastrophe
Lecture 3 – Particle Nature of Light
Lecture 4 – Atomic Energy Levels and Spectra
Lecture 5 – X-ray Production and Diffraction
Lecture 6 – X-ray Spectra
Lecture 7 – Matter Waves

Lecture 8 – Wave-Particle Duality

Lecture 9 – Wave functions for Quantum Particles
Lecture 10 – A Quantum Mechanical Wave Equation
Lecture 11 – Applications of Schrödinger’s Equation

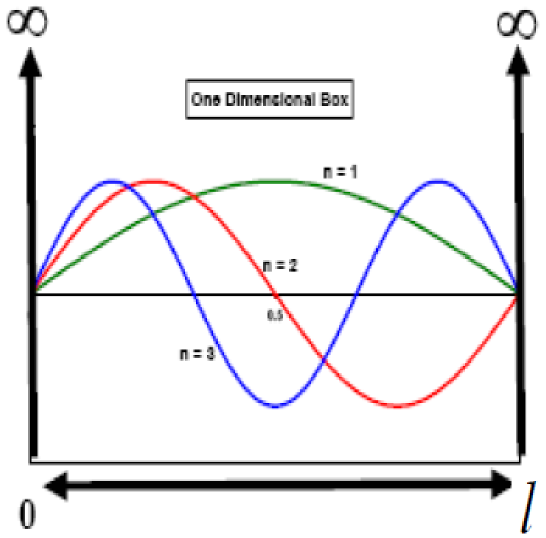
Recap of Lecture 7

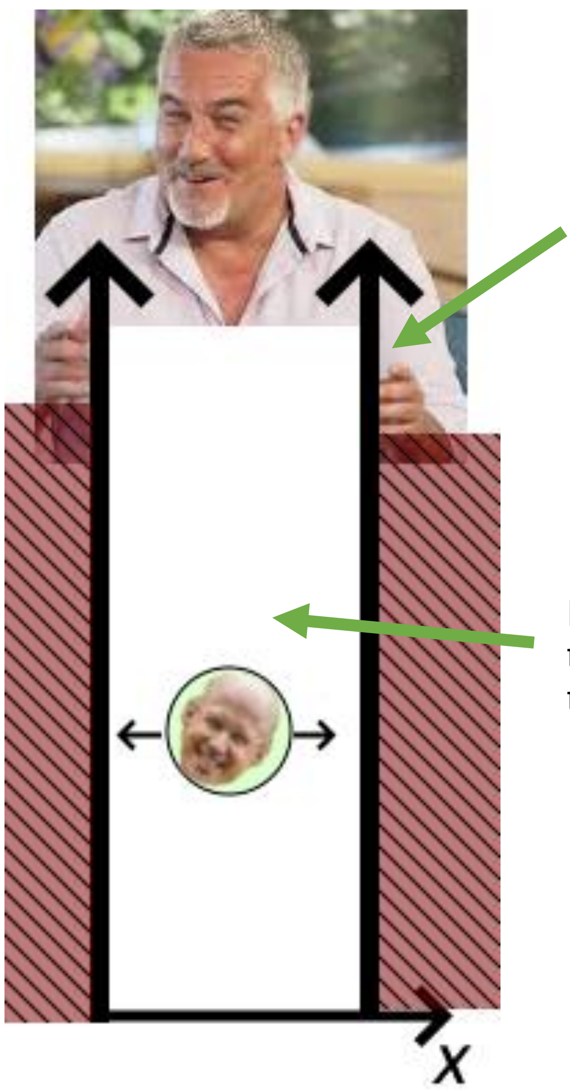
- Matter has a de Broglie wavelength – has wave-like nature
- Electron diffraction – experiments showed particles to interfere, just like the X-rays
- Assuming electrons to be wavey (integer de Broglie wavelengths in an orbit so they match up) we can derive the Bohr model – and put physical meaning behind it

In this lecture

- Particles acting as waves and vice versa – depends on how we look at / measure them
- Infinite potential well – quantisation of energy in bound states, zero-point energy
- The Heisenberg Uncertainty Principle

Infinite potential well – particle-in-a-box





Mighty fists make movement beyond this line IMPOSSIBLE **-> infinite energy cost**/potential

Particle trapped in this region

Uncertainty Principle

$$\Delta p_x \, \Delta x \geq h/4\pi$$

Werner Heisenberg
(1901-1976)

(1932 Nobel prize for the development of quantum mechanics).