# Heisenberg's Uncertainty Principle

By Callum Ross

# Planck Constant

- $6.626 \times 10^{-34}$ JS
- Quite small
- Reduced Planck constant = $h/2\pi$

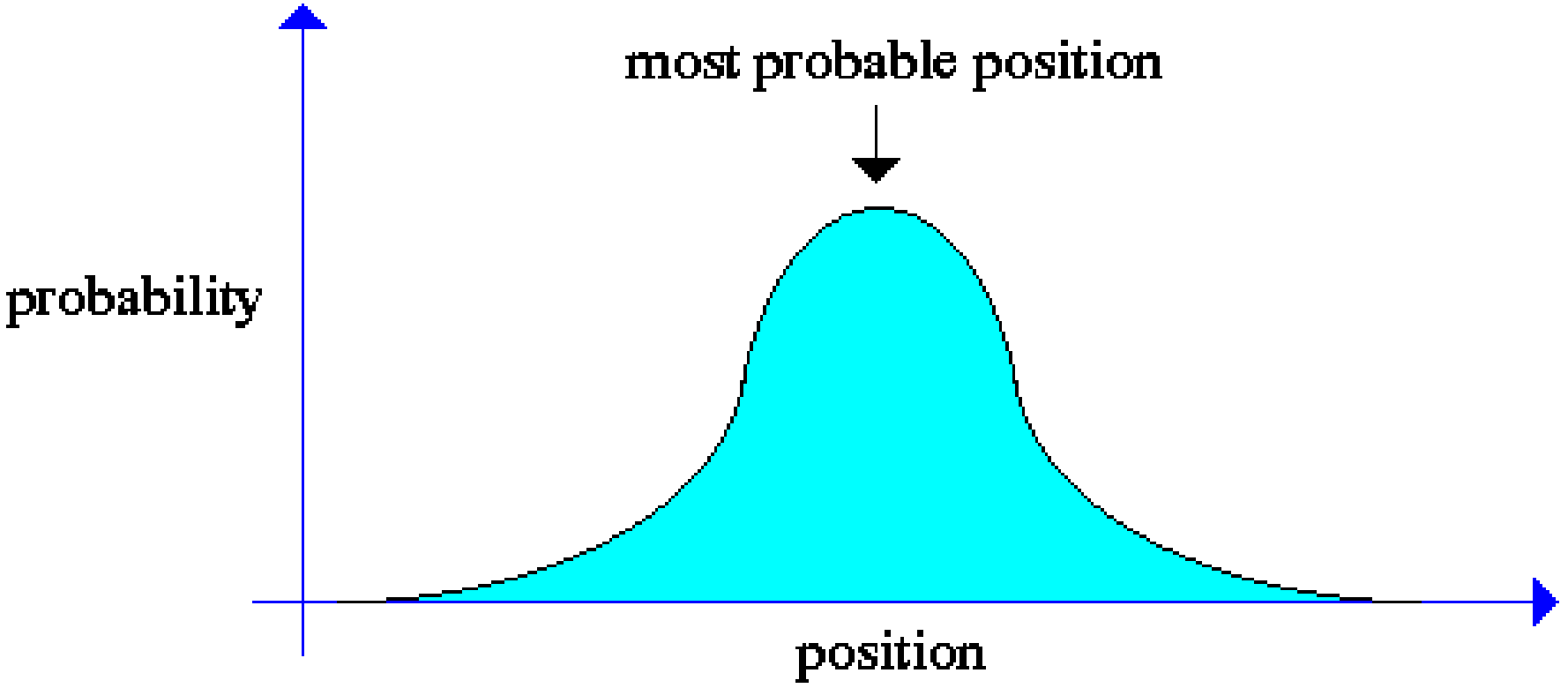
# The Principle

- Uncertainty in position multiplied by uncertainty in momentum is greater than or equal to reduced Planck constant divided by 2.
- The more accurately you know a particle's position, the less accurately you know it's momentum, and vice versa.

$$\Delta x \cdot \Delta p_x \geqslant \frac{\hbar}{2}$$

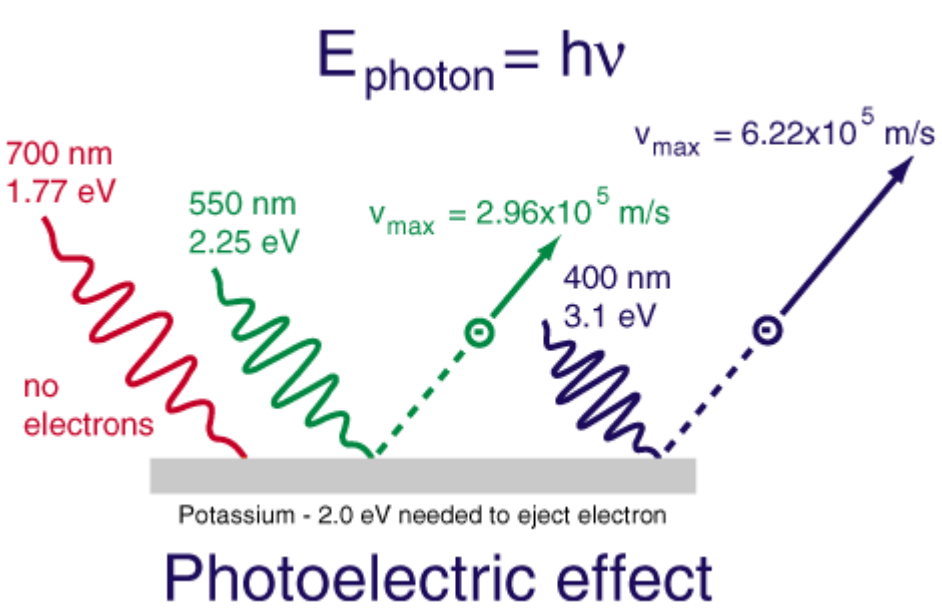
# Quantum Wave Function

Quantum Wave Function

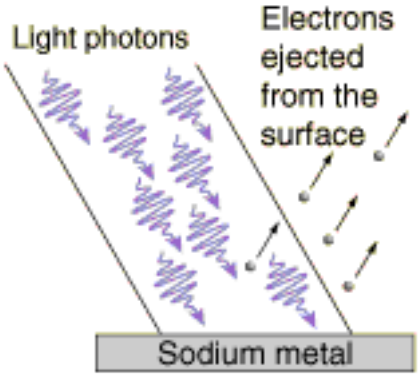


# Photoelectric Effect

- Showed that the energy of the ejected electrons was proportional to the frequency of the illuminating light
- Means energy was independent of each particle




Photoelectric effect




Photon energy

$E = h\nu$

explains the experiment and shows that light behaves like particles.