The Schrödinger Equation

-a wave equation for e⁻ (+ other quantum mechanical "stuff")

Time-Independent:

\[-\frac{\hbar^2}{2m} \nabla^2 \psi + V \psi = E \psi\]

What is \( \psi \)? \( |\psi|^2 = \psi^* \psi \) is the probability distribution of the electron.

\( \text{i.e. } |\psi(x,y,z)|^2 \, dx \, dy \, dz \) is the probability that the electron will be found in the small volume \( dx \, dy \, dz \) at position \((x,y,z)\).

\( E \) is the total energy of the electron
\( V \) is the potential energy of the electron

\( \therefore -\frac{\hbar^2}{2m} \nabla^2 \) must be the kinetic energy of the electron.

But we know that \( \text{K.E.} = \frac{p^2}{2m} \Rightarrow \)

\( p = -i\hbar \nabla \)

So electron wavefunctions that have large gradients (i.e. vary rapidly with distance) have high K.E. + large momentum.

Let's look at some examples...