

5. EXERCISE

Main focus: Simple 1D Schrödinger equation
Normalisation
Potential box with infinite walls

1. Formulate the stationary Schrödinger equation in 1 dimension and determine the normalised wave functions $\Psi(x)$ in a potential box with infinite walls:

$$V = \begin{cases} \infty & : x < 0 \\ 0 & : 0 \leq x \leq L \\ \infty & : x > L \end{cases}$$

- (a) Make a graphical plot of the solutions for the ground state and the first two excited states.
- (b) Calculate the stationary energies of the particle and interpret the result.
- (c) Determine the average position $\langle \bar{x} \rangle$ and average momentum $\langle \bar{p}_x \rangle$ of the particle.
- (d) Calculate the uncertainties Δx and Δp_x and check if the Heisenberg uncertainty principle is fulfilled.