9.4: Particle in a One-dimensional Egg Carton

Numerical Solutions for Schrödinger's Equation

Integration limit: x_{max} = 10 Effective mass: μ = 1

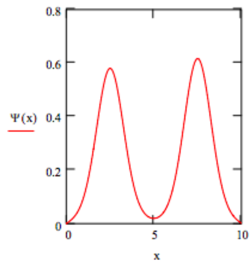
Potential energy: V_o = 2 atoms = 2 $V(x) = V_o(\cos(atoms 2\pi \frac{x}{x_{max}}) + 1)$

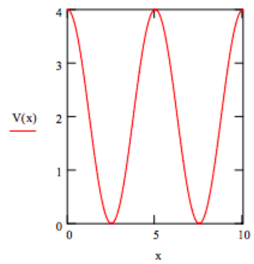
Numerical integration of Schrödinger's equation:

Given $\frac{-1}{2\mu}\psi(x) + V(x)\psi(x) = E\psi(x)$ $\psi(0) = 0$ $\psi' = 0.1$

$\psi = Odesolve(x, x_{max})$ Normalize wave function: $\psi(x) = \frac{\psi(x)}{\sqrt{\int_0^{x_{max}} \psi(x)^2 dx}}$

Enter energy guess: E = 0.83583





Fourier transform coordinate wave function into momentum space.

p = -10, -9.9 .. 10 $\Phi(p) = \frac{1}{\sqrt{2\pi}} \int_0^{x_{max}} exp(-ipx)\psi(x)\, dx$