

## 9.4: Particle in a One-dimensional Egg Carton

Numerical Solutions for Schrödinger's Equation

Integration limit:  $x_{\max} = 10$  Effective mass:  $\mu = 1$

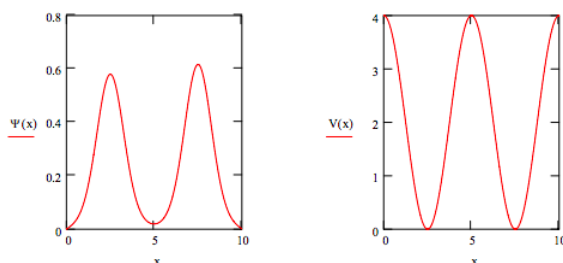
Potential energy:  $V_0 = 2$  atoms = 2  $V(x) = V_0 \left( \cos\left(\text{atoms} 2\pi \frac{x}{x_{\max}}\right) + 1 \right)$

Numerical integration of Schrödinger's equation:

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

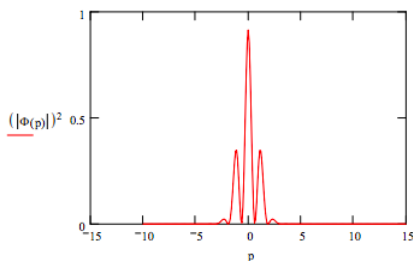
$\psi = \text{Odesolve}(x, x_{\max})$  Normalize wave function:  $\psi(x) = \frac{\psi(x)}{\sqrt{\int_0^{x_{\max}} \psi(x)^2 dx}}$

Enter energy guess:  $E = 0.83583$



Fourier transform coordinate wave function into momentum space.

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



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