Numerical Solutions for Schrodinger's Equation

Integration limit: \( x_{\text{max}} := 10 \)  
Effective mass: \( \mu := 1 \)

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

Numerical integration of Schrödinger's equation:

Given \( \frac{-1}{2 \cdot \mu} \frac{d^2}{dx^2} \Psi(x) + V(x) \cdot \Psi(x) = E \cdot \Psi(x) \)  
\( \Psi(0) = 0 \)  
\( \Psi'(0) = 0.1 \)

\( \Psi := \text{Odesolve}(x, x_{\text{max}}) \) \hspace{1cm} \text{Normalize wave function:} \( \Psi(x) := \frac{\Psi(x)}{\sqrt{\int_0^{x_{\text{max}}} \Psi(x)^2 \, dx}} \)

Enter energy guess: \( E = .83583 \)

Numerical Solutions for Schrödinger's Equation

Fourier transform coordinate wave function into momentum space.

\( p := -10, -9.9, \ldots, 10 \)  
\( \Phi(p) := \frac{1}{\sqrt{2 \cdot \pi}} \int_0^{x_{\text{max}}} \exp(-i \cdot p \cdot x) \cdot \Psi(x) \, dx \)