CHAPTER OVERVIEW

4: One-Dimensional Potentials

In this chapter, we shall investigate the interaction of a non-relativistic particle of mass m and energy E with various one-dimensional potentials, $V(x)$. Because we are searching for stationary solutions with unique energies, we can write the wavefunction in the form (see Section [sstat])

$$\psi(x,t) = \psi(x)\,\mathrm{e}^{-\mathrm{i}\,E\,t/\hbar}, \tag{4.1}$$

where $\psi(x)$ satisfies the time-independent Schrödinger equation:

$$\frac{d^{\,2}\psi}{dx^{\,2}} = \frac{2\,m}{\hbar^{\,2}}\,[V(x)-E]\,\psi. \tag{4.2}$$

In general, the solution, $\psi(x)$, to the previous equation must be finite, otherwise the probability density $|\psi|^{\,2}$ would become infinite (which is unphysical). Likewise, the solution must be continuous, otherwise the probability current ([eprobc]) would become infinite (which is also unphysical).

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