額外練習習題

1. Consider an electron moving from left $x=-\infty $ to right $x=\infty $ and is scattered by a step potential at $x=0$. The step potential is: $V=0, x<0$ and $V=V\_{0}, x>0$.



A wave packet formulation of this scattering can be approximated by considering the stationary energy eigenfunction of this step potential. The solution is:

$$ψ\_{E}=e^{ikx}+Re^{-ikx} x<0 k≡\sqrt{\frac{2mE}{ℏ^{2}}}$$

$$ψ\_{E}=Te^{iqx} x>0 q≡\sqrt{\frac{2m}{ℏ^{2}}\left(E-V\_{0}\right)}$$



Calculate the probability density as a function of $x$ in terms of $T,R,k$ at $x<0.$ It is a constant at $x>0$.

解答：$P=\left|e^{ikx}+Re^{-ikx}\right|^{2}=\left(e^{-ikx}+Re^{ikx}\right)∙\left(e^{ikx}+Re^{-ikx}\right)=1+R^{2}+R\left(e^{i2kx}+e^{-i2kx}\right)=1+R^{2}+2R\cos(2kx)$。











