Laboratorio 1 FISI 6510

Guillermo A. Fidalgo Rodríguez

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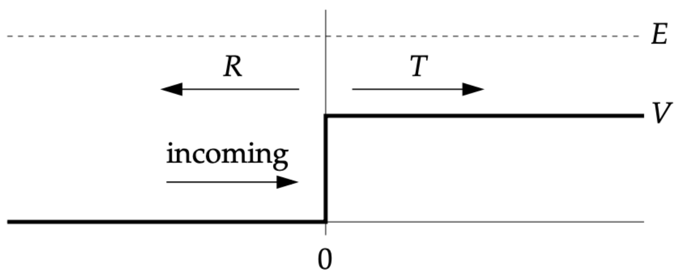
A well-known quantum mechanics problem involves a particle of mass m that encounters a one-dimensional potential step, like this:



The particle with initial kinetic energy E and wavevector $k_1 = \sqrt{2mE}/\hbar$ enters from the left and encounters a sudden jump in potential energy of height V at position $x = 0$. By solving the Schrödinger equation, one can show that when $E > V$ the particle may either (a) pass the step, in which case it has a lower kinetic energy of $E - V$ on the other side and a correspondingly smaller wavevector of $k_2 = \sqrt{2m(E-V)}/\hbar$, or (b) it may be reflected, keeping all of its kinetic energy and an unchanged wavevector but moving in the opposite direction. The probabilities T and R for transmission and reflection are given by

$$T = \frac{4k_1k_2}{(k_1+k_2)^2}, \qquad R = \left(\frac{k_1-k_2}{k_1+k_2}\right)^2.$$

Suppose we have a particle with mass equal to the electron mass $m = 9.11 \times 10^{-31}$ kg and energy 10 eV encountering a potential step of height 9 eV. Write a Python program to compute and print out the transmission and reflection probabilities using the formulas above.

Importando módulos

[1]:
```
import numpy as np
```

[2]:
```
# inicializando parámetros
m = 9.11e-31
h=6.626e-34
hbar=h/(2*np.pi)
E=10 #eV
V= 9 #eV
```

Definimos los números de onda

$$k_1 = \frac{\sqrt{2mE}}{\hbar} \tag{1}$$

$$k_2 = \frac{\sqrt{2m(E-V)}}{\hbar} \tag{2}$$

[3]:
```
k1=np.sqrt(2*m*E)/hbar
k2=np.sqrt(2*m*(E-V))/hbar
```

Definimos la probabilidad de transmisión y reflexión

$$T = \frac{4k_1k_2}{(k_1+k_2)^2} \qquad R = \left(\frac{k_1-k_2}{k_1+k_2}\right)^2$$

[4]:
```
T= 4*k1*k2/(k1+k2)**2
R= ((k1-k2)/(k1+k2))**2
```

[5]:
```
print("La probabilidad de transmisión es {} \ny la probabilidad de reflexión es␣
↪{}".format(T,R))
```

```
La probabilidad de transmisión es 0.7301261363877615
y la probabilidad de reflexión es 0.26987386361223836
```