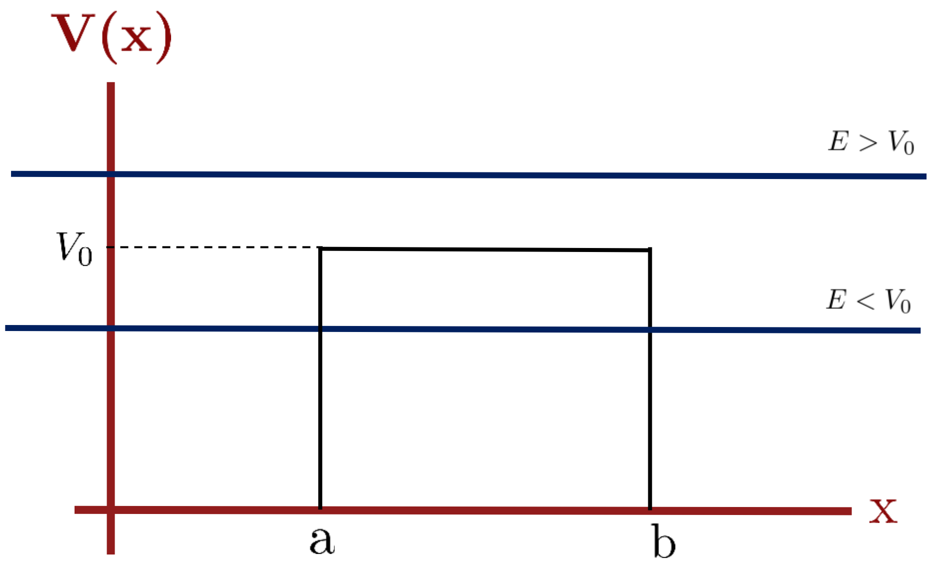
Desarrollo Rectangular

Picture



$$-\frac{\hbar^2}{2m}\frac{d^2\psi}{dx^2} + V(x)\psi = E\psi$$

Caso $E < V_0$

$$\Psi(x) = \begin{cases} Ae^{ikx} + Be^{-ikx} & x < a \\ C\,e^{qx} + D\,e^{-qx} & a \leq x \leq b \\ F\,e^{ikx} + G\,e^{-ikx} & x > b \end{cases}$$

Caso $E > V_0$

$$\Psi(x) = \begin{cases} Ae^{ikx} + Be^{-ikx} & x < a \\ C\,e^{iqx} + D\,e^{-iqx} & a \leq x \leq b \\ F\,e^{ikx} + G\,e^{-ikx} & x > b \end{cases}$$

$$\gamma = \frac{m_2}{m_1} \qquad k = \sqrt{\frac{2m_1E}{\hbar^2}} \qquad q = \sqrt{\frac{2m_2|V_0 - E|}{\hbar^2}}$$

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Matrices de Transferencia

$$\begin{pmatrix} A \\ B \end{pmatrix} = M_1^{-1} M_2 M_3^{-1} M_4 \begin{pmatrix} F \\ G \end{pmatrix}$$

$$\begin{pmatrix} A \\ B \end{pmatrix} = M(a^-, b^+) \begin{pmatrix} F \\ 0 \end{pmatrix}$$

Caso $E < V_0$

$$M(a^-, b^+) = \begin{pmatrix} e^{-ikL}\left[\cosh(qL) + i\frac{(k\gamma)^2 - q^2}{2kq\gamma}\sinh(qL)\right] & -e^{-ik(b+a)} i\frac{(k\gamma)^2 + q^2}{2kq\gamma}\sinh(qL) \\ e^{ik(b+a)} i\frac{(k\gamma)^2 + q^2}{2kq\gamma}\sinh(qL) & e^{ikL}\left[\cosh(qL) - i\frac{(k\gamma)^2 - q^2}{2kq\gamma}\sinh(qL)\right] \end{pmatrix}$$

Caso $E > V_0$

$$M(a^{\tilde{-}}, b^+) = \begin{pmatrix} e^{-ikL}\left[\cos(qL) + i\frac{(k\gamma)^2 + q^2}{2kq\gamma}\sin(qL)\right] & -e^{-ik(b+a)} i\frac{(k\gamma)^2 - q^2}{2kq\gamma}\sin(qL) \\ e^{ik(b+a)} i\frac{(k\gamma)^2 - q^2}{2kq\gamma}\sin(qL) & e^{ikL}\left[\cos(qL) - i\frac{(k\gamma)^2 + q^2}{2kq\gamma}\sin(qL)\right] \end{pmatrix}$$

Con $L = b - a$

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Transmitancia y Reflectancia

$$T = \left|\frac{\mathbf{j}_{\text{trans}}}{\mathbf{j}_{\text{inc}}}\right|^2 \qquad R = \left|\frac{\mathbf{j}_{\text{ref}}}{\mathbf{j}_{\text{inc}}}\right|^2$$

$$T = \left|\frac{F}{A}\right|^2 \qquad R = \left|\frac{B}{A}\right|^2$$

$$\boxed{T(E) = \begin{cases} \dfrac{1}{1 + \frac{[(k\gamma)^2+q^2]^2}{4k^2q^2\gamma^2}\sinh^2(qL)} & \text{si } E < V_0 \\ \dfrac{1}{1 + \frac{[(k\gamma)^2-q^2]^2}{4k^2q^2\gamma^2}\sin^2(qL)} & \text{si } E > V_0 \end{cases}}$$

$$\boxed{R(E) = \begin{cases} \dfrac{\frac{[(k\gamma)^2+q^2]^2}{4k^2q^2\gamma^2}\sinh^2(qL)}{1 + \frac{[(k\gamma)^2+q^2]^2}{4k^2q^2\gamma^2}\sinh^2(qL)} & \text{si } E < V_0 \\ \dfrac{\frac{[(k\gamma)^2-q^2]^2}{4k^2q^2\gamma^2}\sin^2(qL)}{1 + \frac{[(k\gamma)^2-q^2]^2}{4k^2q^2\gamma^2}\sin^2(qL)} & \text{si } E > V_0 \end{cases}}$$

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Resonancias

De,

$$q = \sqrt{\frac{2m_2|V_0 - E|}{\hbar^2}}$$

Cuando $E > V_0$, en las regiones donde se maximiza la transmitancia, es decir $T = 1$, las energias donde se maximiza esta son,

$$E_n = V_0 + \frac{\hbar^2\pi^2 n^2}{2m_2 L^2}$$

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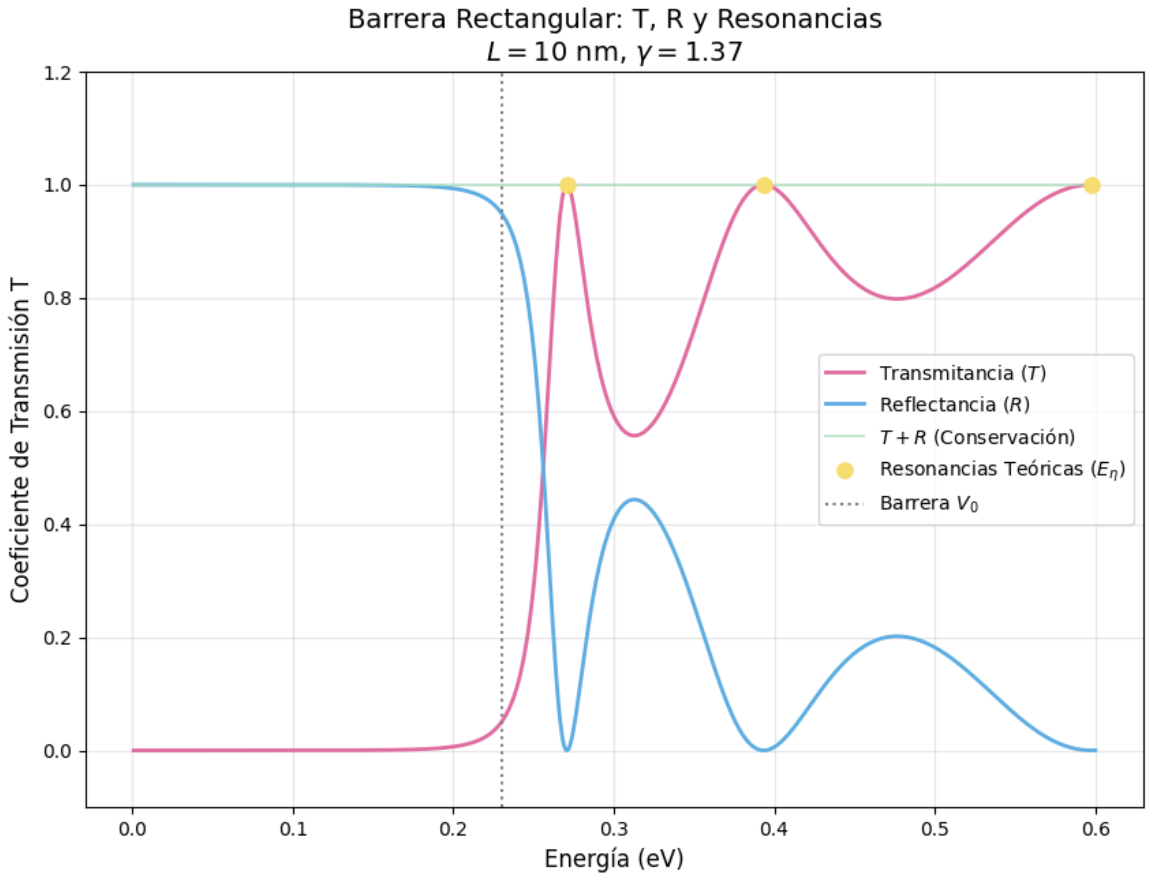
Representación 2-Dimensional



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Representación 3-Dimensional