Quantum Tunneling

Abstract

We present a comprehensive analytical treatment of quantum tunneling through a one-dimensional potential barrier, focusing on the behavior of the transmission coefficient $T(\eta)$ as a function of the dimensionless energy parameter $\eta = \frac{E}{V_0}$. By deriving expressions for all three regimes $- E < V_0$, $E = V_0$, and $E > V_0 -$ and proving the continuity of $T(\eta)$ at $\eta = 1$ using L'Hôpital's Rule, we highlight an often-overlooked but pedagogically valuable aspect of the standard quantum mechanics curriculum. We supplement our results with numerical plot using Python to illustrate key features of tunneling behavior across energy regimes.