

Denny Lane B. Sombillo

University of the Philippines

Tunneling time operator in quantum time of arrival formalism

Authors: Denny Lane B. Sombillo and Eric A. Galapon

Tunneling is an example of quantum phenomena with no classical counterpart. This means that the construction of a tunneling time operator cannot be done using the quantization of a classical observable. In this work we demonstrate how to construct a tunneling time operator using the quantum time of arrival formalism. This is done by taking the classical limit of the time of arrival operator with a square barrier potential. The dynamics of the tunneling time operator is explored by evolving its eigenfunctions. The result shows that the probability of finding the particle within the barrier region is a maximum at time equal to the operator's eigenvalue. We also calculate the resulting tunneling time distribution using a Gaussian incident wave function for different barrier height and barrier width. The peak of the distribution shifts toward lower values of tunneling time as the barrier height is increased and as the width is decreased.