QUANTUM MECHANICAL ASPECTS OF VERTICAL TRANSPORT AND CAPTURE IN QUANTUM WELLS

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ABSTRACT

We study the effect of an imaginary potential and (separately) of a finite coherence length on the transmission, reflection, and capture fractions for a thermal distribution of carriers incident on a single quantum well. The formalism used is closely related to one used by Kuhn and Mahler for the same purpose. Closed form expresions are obtained for the three transport fractions resulting from a single incident beam. Three independent fitting parameters are used in this formalism, namely, the size of the imaginary potential, the extent it penetrates into the barriers adjacent to the well, and the phase coherence length. This last is a length scale associated with a correlation function that appears when the phase of the wave function is treated as a stochastic variable. We show that the parameters can be chosen so that the transport fractions agree with those calculated from first principles, and show how a shortening of the coherence length, e.g., by electron-electron interactions that have been left out of the first principles calculation, destroys the resonant behavior of these fractions predicted by Brum and Bastard.

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