Analytical Approximations to the Dynamics of Superparabolic Level Crossing Models

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Abstract

We study the dynamics of a two-level crossing model with a cubic modification of the linear Landau-Zener tunneling, and express the non-adiabatic transition amplitudes in terms of the bi-confluent Heun functions which are generalizations of the confluent hypergeometric functions. We find a closed-form series expression of the transition probability at the long time limit, and derive tractable approximate formulas to the state populations by use of simple functions in a large part of the parameter space. The analytical approximations are validated by comparison with numerical results.

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