2014 9 No.314 since 2001)

Effects of finite time on Landau-Zener transition

Landau-Zener transition (LZT) is a ubiquitous phenomenon in quantum systems with time-dependent Hamiltonians. LZT has broad applications in atomic and molecular physics, quantum optics, condensed matter physics, chemical physics, and quantum information science. For instance, LZT has been used as tunable "beam splitters" for quantum mechanical wave functions to generate entangled multipartite states. Recently, its potential for robust manipulation of coherent quantum states and simulating quantum phase transition has attracted much attention. We demonstrate, via experiment and numerical simulations, under conditions often found in superconducting qubits LZT probability PLZ could deviate significantly from that given by the asymptotic LZ formula. Under proper conditions, in contrast to the smooth exponential dependence on the Landau-Zener speed v predicted by the LZ formula PLZ oscillates as a function of v and the starting/finishing point of the energy sweep due to finite evolution time. We show that if not taking into consideration the effects of finite time on LZT could lead to significant errors for single- and two-qubit quantum gates based on various rapid adiabatic passage methods.

4 24 15:00 16:30

212

“

”

htquan@pku.edu.cn

Photograph by Xiaodong Hu