Dynamics of Adiabatic Rapid Passage in an Open Rabi Dimer Model

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Abstract : Adiabatic Rapid Passage, a popular method of achieving population inversion, is studied in a Rabi dimer model in the presence of noise which acts as a dissipative environment. The integration of the multi-Davydov D2 Ansatz into the time-dependent variational framework enables us to model the intricate quantum system accurately. By influencing the system with a driving field strength resonant with the energy spacing, the probability of adiabatic rapid passage, which is modelled after the Landau Zener model, can be derived along with several other observables, such as the photon population. The effects of a dissipative environment can be reproduced by coupling the system to a common phonon mode. By manipulating the strength and frequency of the driving field, along with the coupling strength of the phonon mode to the qubits, we are able to control the qubits and photon dynamics and subsequently increase the probability of Adiabatic Rapid Passage happening.