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Adiabatic evolution and dephasing

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Lindbladians are generators of the effective dynamics of open quantum systems. We focus on dephasing Lindbladians. Like Hamiltonians of isolated quantum mechanical system, but in contrast to generic Lindbladians, they exhibit several stationary states.

The adiabatic evolution of an isolated quantum mechanical system exhibits no irreversible transitions if its Hamiltonian undergoes a slow, transient time-dependence. By contrast, if a dephasing Lindbladian undergoes such a change, transitions are typically irreversible. I'll present a formulation of the adiabatic theorem which accounts for the different kinds of transition, though treating Hamiltonian and Lindbladian dynamics on equal footing. It will be followed by a number of applications.

The first application is concerned with the transition probability in an avoided crossing and the replacement of the Landau-Zener formula when dephasing is added.

The second one is the solution of an optimization problem. Given are a path of dephasing Lindbladians, two states (”initial” and ”terminal”) which are stationary w.r.t. the corresponding endpoint, and an amount of time to be spent. Sought is time schedule to be used on the path in order to bring the evolved state as close as possible to the terminal state. An application to the Grover search algorithm will be mentioned.

Last we apply the result to transport and linear response theory. In the context of dephasing Lindbladians, the coefficients of dissipative conductance are determined by a Fubini-Study metric, while their non-dissipative counterparts are determined by the adiabatic curvature. If the metric and the (symplectic) curvature form are compatible, in the sense of defining a Kähler structure, then the non-dissipative resistance coefficients are immune to dephasing. We give some examples of compatible systems.

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