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Quantum annealing of an open quantum system

In the practical situation of quantum annealing like in a D-Wave's computer, the effect of thermal environment is unavoidable. Therefore it is quite important to investigate the time evolution of a quantum spin system coupled to a thermal bath. Recently, we have developed a novel numerical method that can be applied to the time evolution of a disordered transverse Ising chain coupled to a bosonic bath. This method is based on the combination of the quasi-adiabatic path integral and the density matrix renormalization group. With the numerical results, we will discuss what happens to the spin state during quantum annealing. Our study will provide a hint on the design of an efficient quantum annealing in a thermal environment.

