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Behavior of Spin Systems with a First-Order Phase Transition under Dissipation

We study the properties of phase transitions of the spin system with p -body infinite-range ferromagnetic interactions in a transverse field coupled to the bosonic environment. In addition, we append transverse antiferromagnetic interactions, which exponentially enhance the efficiency of quantum annealing. Phase diagrams of this model reveal that interactions of the transverse components of the spins with the environment effectively produce transverse ferromagnetic interactions and are detrimental to quantum annealing. In contrast, interactions between the longitudinal components and the environment yield transverse antiferromagnetic interactions and improve the efficiency of quantum annealing. This work was done in collaboration with Hidetoshi Nishimori.