Existence of Ground States in the Spin Boson Model

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Abstract

The spin boson model describes a two-level quantum mechanical system, called spin, linearly coupled to a field of bosons. If one assumes the bosons to be massive, then the system has a spectral gap and hence a ground state exists. However, in the case of massless bosons the spectral gap closes and the existence of ground states becomes non-trivial. In fact, in this infrared-critical situation, it has been observed in other models of non-relativistic quantum field theory that no ground state can exist. However, due to the so-called spin flip symmetry, the spin boson model does exhibit a ground state in the infrared-critical case provided the absolute value of the coupling constant is sufficiently small. In this talk, we discuss a new non-perturbative proof for the existence of ground states in this situation, which especially gives a simple explicit upper bound on the absolute value of the coupling constant. We further argue towards the conjecture that there exists no ground state for coupling constants with absolute value larger than a critical value.

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