Ion-trap simulation of the quantum phase transition in an exactly solvable model of spins coupled to boso

Gian Luca Giorgi, Simone Paganelli, Fernando Galve

(Submitted on 1 Feb 2010)

It is known that arrays of trapped ions can be used to efficiently simulate a variety of many-body quantum systems. Here, we show how it is possible to build a model representing a spin chain interacting with bosons which is exactly solvable. The exact spectrum of the model at zero temperature and the ground state properties are studied. We show that a quantum phase transition occurs when the coupling between spins and bosons reaches a critical value, which corresponds to a level crossing in the energy spectrum. Once the critical point is reached, the number of bosonic excitations in the ground state, which can be assumed as an order parameter, starts to be different from zero. The population of the bosonic mode is accompanied by a macroscopic magnetization of the spins. This double effect could represent an useful resource for the phase transition detection since a measure on the phonon can give information about the phase of t spin system. A finite temperature phase diagram is also given in the adiabatic regime.

Subjects: **Quantum Physics (quant-ph)**
Cite as: **arXiv:1002.0252v1 [quant-ph]**

Submission history

From: Gian Luca Giorgi [view email]
[v1] Mon, 1 Feb 2010 14:01:13 GMT (55kb)

Which authors of this paper are endorsers?