Quantum Magnetism and Quantum Entanglement

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Lecture I: Quantum Magnetism (A brief introduction, Applications in many-body physics, Conclusions)

In many-body physics, quantum spin systems have received a lot of attentions due to their importance in the description of different phenomena such as antiferromagnetic Mott insulating behavior, Bose-Einstein condensation (BEC), super-solidity and gapless Luttinger liquid physics. Apart from pure scientific interest, spin systems possess a potential for various technological applications such as nano-technology and quantum computations. In this lecture I will briefly introduce the magnetic quantum models, and talk about their ground state, magnetic and thermodynamic properties.

References:

[1] Stephan Blundell, Magnetism in Condensed Matter, Oxford University Press (2001),

[2] Robert M. White, Quantum Theory of Magnetism, Springer (2006),

[3] U. Schollwock, J. Richter, D. J. J. Farnell, R. F. Bishop (Eds.), Quantum Magnetism, Lect. Notes Phys., Springer (2004).

[4] P. Fazekas, Lecture Notes on Electron Correlations and Magnetism, World Scientific (2003).

[5] More Refs will be introduced in my lecture notes.

Lecture II: Quantum Entanglement (Introduction, Applications in quantum spin systems, Conclusions)

Entanglement is a kind of quantum nonlocal correlation which is used as an indicator of quantum phase transitions. Condensed matter systems can be efficiently simulated using techniques related to entanglement. The usefulness of entanglement in condensed matter physics leads us to study it in the quantum spin systems. In this lecture I will give some points about the entanglement and its measures in bipartite spin lattices. I will also talk about the relationship of the entanglement and correlation functions.

References:

[1] L. Amico, R. Fazio, A. Osterloh, V. Vedral, Entanglement in many-body systems, Rev. Mod. Phys. 80, April-June (2008),

[2] More Refs will be introduced in my lecture notes.