Center for Quantum Science and Engineering (CQSE)

Weekly Seminar
Oct. 22, 2010 (Friday)

TIME Oct. 22, 14:30 ~ 15:30

TITLE Revisiting the phase transition of the spin-1/2 Heisenberg model with a spatially staggered anisotropy on the square lattice

SPEAKER Dr. Fu-Jiun Jiang 江府峻博士
Department of Physics, NTNU

PLACE Rm716, CCMS & New Physics Building, NTU

Abstract

Puzzled by the indication of a new critical theory for the spin-1/2 Heisenberg model with a spatially staggered anisotropy on the square lattice as suggested in Wenzel, Bogacz, Janke, PRL 2008, we re-investigate the phase transition of this model induced by dimerization using first principles Monte Carlo simulations. To understand any subtlety of studying the critical theory of a second order phase transition, we first simulate a similar model on the honeycomb lattice. By carrying out finite-size scaling analysis on the observables $\rho_{s1}L$ and Q_2, we can obtain a consistent ν with the expected $O(3)$ value $\nu=0.7112(5)$ only using data points of large lattices. Here ρ_{s1} is the spin stiffness in 1-direction, L is the box size and Q_2 is the second Binder ratio. Next we turn to study the phase transition of our central interest. By employing an unconventional finite-size scaling ansatz, namely we fix the aspect ratio of spatial winding numbers squared in the simulations, unlike the unexpected result of $\nu = 0.689(5)$ obtained in Wenzel, Bogacz, Janke, PRL 2008, we reach a consistent value for ν with $\nu=0.7112(5)$ using only up to $L=64$ data points. We argue the unconventional finite-size scaling ansatz employed here is natural and should lead to a more accurate determination of the critical exponent ν.