行政院國家科學委員會專題研究計畫  期中進度報告

強關聯電子系統的有效場論及相干態理論研究

計畫類別：個別型計畫
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Two topics are in progress:

1. A Low-Energy Multi-pairing Theory for High Tc Superconductivity by Wei-Min Zhang. In this work, I am trying to develop a low energy multi-pairing theory for high Tc superconductivity. For a strongly correlated electron system, the normal and Umklapp processes of the two-body electron interactions may control the many properties of the underlying low-energy orders of the system embedded in a SO(8) dynamical group. The quantum ground state (the exact quasiparticle ground state) of the system and its phase diagram can be described by the SO(8) coherent multi-pairing state. The single electron structure can also be determined from the SO(8) constrained Bogoliubov transformation within the same framework. I apply this theory to high Tc cuprates, and find that besides the familiar antiferromagnetic (AF) spin order and SdS-wave superconducting (dSC) charge order, there are two other orders, a hopping induced charge-bonding order and the staggered charge current order, also paly a crucial role in the transition of the AF phase near the half-filling to the dSC phase in the optimally doped region, in particular in the interpretation of the pseudogap in the underdoped region.

2. Quantum Nonlinear Sigma Model for Arbitrary Spin Heisenberg Antiferromagnets by Wei-Min Zhang. Based on the theory of quantum nonlinear sigma model for Heisenberg antiferromagnets with arbitrary spin value I developed recently, I am apply this theory to describe various one-dimensional and two-dimensional quantum Heisenberg model with small spin values.