Spin and Charge Dynamics on the Triangular Kagome Lattice

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Abstract

We would like to present our work on a new type of lattice which is called Triangular Kagome Lattice (TKL). We obtain the exact solutions for the Ising model, Heisenberg-Ising model and dimer model on the TKL. The free energy, internal energy, specific heat, entropy, sublattice magnetizations, and susceptibility are presented. The rich phase diagrams as a function of coupling constants, temperature, and applied magnetic field are obtained. For frustrated Ising case, the ground state is a spin liquid phase with residual entropy per spin (ln72)/9. For the Heisenberg-Ising case, a small field leads to a new phase that corresponds to a nonintersecting loop gas on the Kagome lattice. Using the Pfaffian method, we derive an exact form for the free energy of dimer model on the TKL, and we find that the entropy is 1/3 ln2 per site. Recently we obtain the rich phase diagrams in the Hubbard model on the TKL as a function of interaction, temperature, and asymmetry by combining the cellular dynamical mean-field theory with the continuous time quantum Monte Carlo method. The phase diagrams show the asymmetry separates the critical points in the Mott transition of two sublattices on the TKL and produces two novel phases called plaquette insulator with a clearly visible gap and a gapless Kondo metal. When the Coulomb interaction is stronger than the critical value Uc**,** a short range paramagnetic insulating state, which is a candidate for the short rang resonating valence-bond spin liquid emerges.

References:

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About the speaker

Prof Daoxin Yao obtained his PhD at Boston University. He then worked at Purdue University, University of Tennessee and Oak Ridge National Laboratory. In 2009, he joined Sun Yat-sen University in Guangzhou, China as a professor. He mainly works on condensed matter theory, correlated electron systems, magnetism, quantum phase transitions, topological materials, and quantum information.