Joint CQSE and CASTS Seminar

Weekly Seminar
Sep. 21, 2012 (Friday)

TIME Sep. 21, 14:30 ~ 15:30
TITLE Quantum Ice: A Quantum Monte Carlo Study
SPEAKER Dr. Olga Sikora
Department of Physics, National Taiwan University
PLACE Rm716, CCMS & New Physics Building, NTU

Abstract

Ice states, characterized by macroscopic ground state degeneracy due to frustrated interactions, occur in water ice, in problems of frustrated charge order on the pyrochlore lattice, and in the family of rare-earth magnets known as spin ice (with fascinating "magnetic monopole" excitations).

At very low temperatures we might expect this degeneracy to be lifted by quantum tunneling between different ice configurations. We show the results of large-scale Green's function Monte Carlo simulation of quantum ice models. We find compelling evidence of an extended quantum U(1)-liquid ground state with deconfined monopole excitations in both the quantum dimer model and the quantum ice model on the diamond lattice. We discuss the fate of "pinch point" singularities seen in neutron scattering experiments on spin ice materials, showing how these are "hollowed out" in the quantum ice model.

Nic Shannon, Olga Sikora, Frank Pollmann, Karlo Penc and Peter Fulde, Phys. Rev. Lett. 108, 067204 (2012).