

DEPARTMENT OF PHYSICS

CMT Seminar

Monday, February 06, 2017

11:30am Robert Smith Seminar Room

1080 Smith Seminar Room

Gang Chen

Fudan University, Department of Physics



"Monopole Condensation" Transition out U(1)

Quantum Spin Liquid: Application to $\text{Pr}_2\text{Ir}_2\text{O}_7$

Abstract: We study the proximate magnetic orders and the related quantum phase transition out of U(1) quantum spin liquid. We apply the electromagnetic duality of the compact quantum electrodynamics to analyze the condensation of the "magnetic monopoles" for U(1) quantum spin liquid. The monopole condensation transition represents a unconventional quantum criticality with unusual scaling laws. The magnetic monopole condensation leads to the magnetic states that belong to the "2-in 2-out" spin ice manifold and generically have an enlarged magnetic unit cell. We demonstrate that the antiferromagnetic state with the ordering wavevector $Q = 2\pi (001)$ is proximate to U(1) quantum spin liquid while the ferromagnetic state with the ordering wavevector $Q = (000)$ is not proximate to quantum spin liquid. This implies that if there exists a direct transition from U(1) quantum spin liquid to the ferromagnetic state, the transition must be strongly first order. We apply the theory to the puzzling experiments on two pyrochlore systems $\text{Pr}_2\text{Ir}_2\text{O}_7$.

FACULTY HOST: Yuan-Ming Lu



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