清华大学高等研究院

Institute for Advanced Study, Tsinghua University

物理学术报告
Physics Seminars (biweekly)

Title: **topological states of matters in classical and quantum magnets**

Speaker: **Prof. Ryuichi Shindou**
(*International Center for Quantum Materials, Peking University*)

Time: **3:15pm, Wednesday, Nov. 20, 2013**
(2:45~3:15pm, Tea, Coffee, and Cookie)

Venue: **Conference Hall 322, Science Building, Tsinghua University**

Abstract

Topological phases have been explored in various fields in physics such as semiconductor physics, correlated electron systems, liquid helium-3, cold-atomic systems, and photonics. This leads to the recent foundation of emerging materials such as topological band insulators, topological superconductors/superfluid and topological photonic crystals. In this talk, I will talk about two topological states of matters in magnets; one is topological spin waves in classical magnets and the other is multiple-polar states in quantum magnets. In the first part, I propose magnetostatic spin-wave analog of integer quantum Hall state, in which spin wave propagation with long-wave length (micrometer scale) is driven by magnetic dipole-dipole interaction. Like in relativistic spin-orbit interaction, the dipolar interaction plays role of the spin-orbital locking, so that two-dimensional ferromagnetic thin films with periodic structuring can host spin-wave bands with non-zero Chern integers, which result in topological edge modes for spin-wave propagations. In the 2nd part of the talk, I will argue that a certain multiple-polar states in quantum magnets can be described as a Z2 topological order phase, hosting a similar low-energy effective gauge theory as Z2 quantum spin liquid. A variational ansatz derived from a ``Z2 multiple-polar state'' proposed in a quantum spin model can explain several unusual features found in preceding exact diagonalization studies on the same quantum spin model.