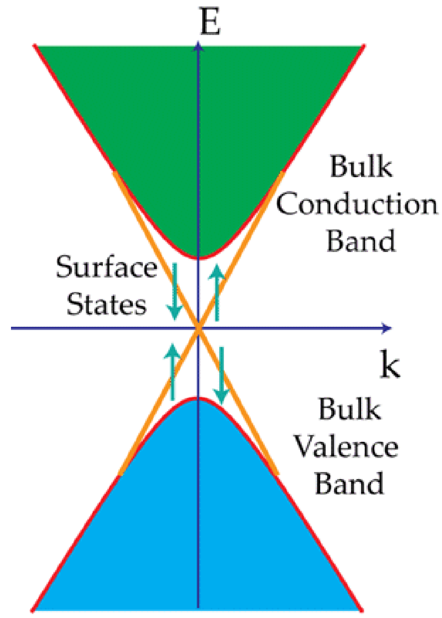
COLLOQUIUM

FRESNO STATE PHYSICS



Dr. Wei Zhu
Theory Division Los Alamos National Lab

Numerical Characterization of Topological States of Matter in Strongly Correlated Systems

Abstract

There is growing interest to study topological states in strongly-correlated systems. In this talk, I will discuss several novel examples of the topological states of matter and quantum criticality in many-body systems, based on the state-of-the-art numerical schemes. In the first part, I propose an extended fermionic Hubbard model on kagome lattice, and unveil the nature of the ground state is equivalent to the quantum anomalous Hall state. This serves as the first solid evidence of topological Mott insulator from a microscopic view point. Significantly, this work provides a "proof-of-principle" demonstration of interaction-driven topological phase in a "gauge-field-free" non-interacting band, without the requirement of external magnetic field or other mechanism of explicit breaking of time-reversal symmetry.In the second part, I focus on the S = 1/2 Heisenberg antiferromagnet model on the kagome lattice, one of the most promising platforms for quantum spin liquid due to its geometric frustration. Experiments on the kagome compound herberthsmithite show that it is a spin liquid, but its nature remains under debate. I target this challenging problem from a new angle based on the entanglement entropy scaling function. The entanglement response to the gauge field reveals the presence of emergent Dirac fermion excitations in this system, which unveils the nature of ground state is U(1) Dirac spin liquid.

2:00-3:00 p.m., Friday, May 4th, McLane Hall 162

Special time. All are welcome!