清华大学高等研究院

Institute for Advanced Study, Tsinghua University

学术报告

Title: **Topological transition from a non-Abelian Yang-Mills monopole**

Speaker: **Ian Spielman**
National Institute of Standards and Technology &
University of Maryland

Time: **4:00pm, Friday, 2016-08-19**

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

Abstract

Understanding and manipulating the topological properties of physical systems plays an important role in quantum science and technology, because global topological properties are robust against local perturbations. For example, topologically protected quantum control gives robust high-fidelity operation1 and the bulk topology of quantum Hall system leads to the quantization of the Hall conductivity to better than one part in a billion2. Topological order is quantified in terms of singularities called topological defects that reside in an extended parameter space. We engineered such a singularity - a non-Abelian Yang monopole - using an atomic Bose-Einstein condensate (BEC) in a five- dimensional parameter space. We quantified the topology of the monopole field by measuring the 1st Chern number – often simply called “the Chern number” - on an enclosing two-dimensional manifold, and by measuring the 2nd Chern number on an enclosing four-dimensional manifold. While the 1st Chern number vanished, the 2nd Chern number did not. Then, by displacing the manifold, we observed a transition from “topological” to “trivial” when the Yang monopole was no longer inside the manifold. Replicas of our system placed on a lattice opens the door for studying high energy phenomena governed by higher gauge symmetries than that of the U(1) symmetry of electrodynamics in an ideal platform.