# 清华大学高等研究院

Institute for Advanced Study, Tsinghua University

## 学术报告

**Title:** **Fractional Topological Phases in Topological Flat Bands**

**Speaker:** **Yi-Fei Wang**
(***Center for Statistical and Theoretical Condensed Matter Physics, Zhejiang Normal University***)

**Time:** **3:15pm, Wednesday, April 2, 2014**

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

## Abstract

Topological flat bands belong to the extensions of the well-known Haldane model; there is at least one energy band with non-trivial topological property, i.e., has a nonzero Chern number; this energy band has a very narrow band-width, and is also separated from the other bands with large gaps. Recent systematic numerical studies of strongly correlated fermions and bosons in lattice systems with topological flat bands, a new class of exotic Abelian and non-Abelian fractional quantum Hall effect has been found. This newly found fractional quantum Hall effect is very different from the continuum fractional quantum Hall effect in conventional Landau levels, happens in the absence of an external strong magnetic field, has large characteristic gaps, can exist at high temperature, without single-particle Landau levels, and can not be described by conventional Laughlin wave functions. This intriguing fractionalization effect, without Landau levels and without external magnetic field, defines a class of fractional topological phases, also known as fractional Chern insulators, and the related fractional quantum Hall effect is also called fractional quantum anomalous Hall effect. This new research area has stimulated a lot of recent research activities and has also been widely concerned. In this talk, I will introduce our recent series of works done with collaborators in this area: the bosonic fractional quantum anomalous Hall effect; the non-Abelian quantum anomalous Hall effect; the high-Chern-number fractional quantum anomalous Hall effect; edge excitations in fractional quantum anomalous Hall states.

1) Y. F. Wang, Z. C. Gu, C. D. Gong, and D. N. Sheng, Fractional Quantum Hall Effect of Hard-Core Bosons in Topological Flat Bands, Phys. Rev. Lett. 107, 146803 (2011)

2) Y. F. Wang, H. Yao, Z. C. Gu, C. D. Gong, and D. N. Sheng, Non-Abelian Quantum Hall Effect in Topological Flat Bands, Phys. Rev. Lett. 108, 126805 (2012)

3) Y. F. Wang, H. Yao, C. D. Gong, and D. N. Sheng, Fractional Quantum Hall Effect in Topological Flat Bands with Chern Number Two, Phys. Rev. B 86, 201101(R) (2012)

4) W. W. Luo, W. C. Chen, Y. F. Wang, and C. D. Gong, Edge excitations in fractional Chern insulators, Phys. Rev. B 88, 161109(R) (2013)