

**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:** Quantum simulation in optical superlattice

**Speaker:** Yu-Ao Chen  
University of Science and Technology of China

**Time:** 3:15 pm, Wednesday, Oct 10, 2012  
(2:45~3:15pm, Tea, Coffee, and Cookie)

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

**Abstract:**

Ultracold atoms in an optical lattice are promising candidates to study quantum many-body phenomena. Bichromatic superlattices provide a novel tool on this direction. In this talk, first I will give an overview of the experiments done in superlattices. Then I will focus on two recent experiments. I will first report the experimental realization of strong effective magnetic fields with ultracold atoms using Raman assisted tunneling in an optical superlattice. We studied the nature of the frustrated ground state in the presence of an effective staggered magnetic field from its momentum distribution and directly revealed the quantum cyclotron orbit of a single atom exposed to the magnetic field. In the next experiment, I will present the direct measurement of the Zak phase - the Berry phase acquired during an adiabatic motion of a particle across the Brillouin zone - for a dimerized optical lattice, which models polyacetylene. The experimental protocol consists of a combination of Bloch oscillations and Ramsey interferometry. This work establishes a new general approach for probing the topological structure of Bloch bands in optical lattices.