



## Seminar

### 4D Ultrafast Electron Microscopy

**Haihua Liu**

*California Institute of Technology*

**Time: 4:30pm, Dec. 8, 2015 (Thursday)**

**时间: 2016年12月8日 (周四) 下午4:30**

**Venue: Room w563, Physics building, Peking University**

**地点: 北京大学物理楼, 西563会议室**

#### Abstract

The 4D UEM technology pioneered by Professor Ahmed Zewail at Caltech since 2004 enables scientist to explore ultrafast events and process that occur at the atomic and molecular spatial scale over time spans measured in femtoseconds ( $10^{-15}$  seconds), the time scale of atomic motions, which is 10 orders of magnitude better than that of conventional microscopes limited by the video-camera rate of recording. Now, 4D UEM has been extensively used in the study of ultrafast dynamics from atomic motions during structural dynamics to phase transitions, nanomechanical oscillations, surface morphology dynamics, observing liquid flow in nanotube, charge density wave, chemical bonding, biology protein dynamics, crystallization etc by various developed UEM techniques. In this talk, I will introduce the development and progress that I made in 4D UEM, such as ultrafast phase transition study of single particle dynamics in  $\text{VO}_2$  ensemble, development of diffraction PINEM to improve energy resolution and study structural dynamics, Photo-gating to improve temporal resolution in UEM, 4D multiple cathode UEM, etc.

#### About the speaker

Dr. Liu Haihua is a Research Scientist in the group of Professor Ahmed Zewail (Nobel laureate in Chemistry) at California Institute of Technology. He obtained his B.Sc. in Applied Physics from Xi'an Jiao Tong University in 2002, and his PhD degree in Condensed Matter Physics from Beijing Laboratory of Electron Microscopy, Institute of Physics, Chinese Academy of Science in 2008. His PhD study focused on the materials characterization by advanced analytical TEM methods. He then moved to Risoe DTU for postdoc research on the development of 3D orientation mapping in the TEM, and joined Prof. Zewail's group at Caltech. Now his research is mainly focused on 4D ultrafast electron microscopy in condensed matter physics and materials science. He has published several papers on Science, PNAS, Nature Communications, and Nano Letters etc.