



中心系列讲座 ICQM Weekly Seminar Series  
“Ultra-fast Dynamics of Materials”



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**Time: 10:00am, Oct. 20, 2011 (Thursday)**  
**时间: 2011年10月20日 (周四) 上午10:00**  
**Venue: Room 607, Science Building 5**  
**地点: 理科五号楼607会议室**

Abstract

Time-resolved pump-probe spectroscopy, by virtue of its ability to create a non-equilibrium exciting state and measure properties at the atomic and electronic time scales, provides a new perspective to directly measure physical processes in quantum materials. This is being made even more interesting with the rapid development of x-ray free electron lasers such as the Linac Coherent Light Source (LCLS). In this talk, I discuss our new research activities in this emerging field by presenting two examples. The first is a combined time-resolved optical and x-ray scattering study, which enabled us to discover two distinct electronic time scales in the dynamics of charge order (CO) in  $\text{La}_{1.75}\text{Sr}_{0.25}\text{NiO}_4$ . This finding reveals the presence of a new class of phase fluctuation, which preserves the long range order without creating topological defects, unlike the thermal fluctuation near the phase transition temperature. This discovery provides a fresh example for the importance of phase in determining orders of complex quantum matter even in the non-equilibrium state. The second example is a pump-probe ARPES investigation of topological insulators. The experiment reveals a rich hierarchy of time scales and set a few bounds to the charge dynamics. In particular, We show that optical excitation leads to a meta-stable population at the bulk conduction band edge, which feeds a none-quilibrium population of the surface state persisting for  $>10$  ps. This unusually long-lived population of a metallic Dirac surface state with spin texture may present a channel in which to drive transient spin-polarized currents.

About the Speaker

Prof. Shen received his Ph.D. in Applied Physics from Stanford University in 1989, M.S. from Rutgers University in 1985, and B.S. from Fudan University in 1983. He is the Paul Pigott Professor in Physical Sciences of Stanford University, and has been a Professor of Physics, Applied Physics, and SLAC Photon Sciences since 2000, an Associate Professor (1996-2000), and Assistant Professor (1992-1996). He is the Chief Scientist of SLAC National Accelerator Laboratory (2010-). He is also the founding Director of the Stanford Institute for Materials and Energy Sciences (SIMES) (2006-).