# Probing Electronic Structure in Novel Engineered Quantum States of Matter

## -- *in-situ* ARPES studies of epitaxial novel oxides thin films

Mingying Li[1], Daniel E. Shai[2], Dawei Shen[1,2,3], Rui Peng[4], Darrell G. Schlom[3], Kyle M. Shen[2] and Donglai Feng[4]

[1] *Superconductor Applications State Key Laboratory of Functional Materials for Informatics, SIMIT, Chinese Academy of Sciences, Shanghai, 200050, China*

[2] *Department of Physics, Cornell University, Ithaca, NY 14853, USA*

[3] *Department of Materials Science and Engineering, Cornell University, Ithaca, New York 14853, USA*

[4] *Department of Physics, Fudan University, Shanghai, 200433, China*

*Speaker's current email address:* dwshen@mail.sim.ac.cn

In this talk, I will mainly introduce how to utilize *in-situ* angle-resolved photoemission spectroscopy (ARPES) to study novel electron systems fabricated/engineered by oxide molecular beam epitaxy (OMBE) technique. Particularly, I will report the first high-resolution ARPES studies on the epitaxial pseudocubic-structured $SrRuO_3$ thin films. The long-standing quasi-particle excitations in $SrRuO_3$ are revealed, which show strong coupling with some low energy bosonic modes. Our measurements demonstrate that it is the strong electron-boson coupling but not the Coulomb interaction proposed previously that is primarily responsible for the large effective masses observed in this material. Moreover, I will present the systematic study of the dead-layer behavior in $La_{0.67}Sr_{0.33}MnO_3$ thin films. The evolution of electric and magnetic properties as a function of thickness shows a remarkable resemblance to the phase diagram as a function of doping for bulk materials, providing compelling evidences of the hole-depletion in near interface layers that causes dead-layer. Detailed electronic and surface structure studies indicate that the hole-depletion is due to the intrinsic oxygen vacancy formation.

*This work were supported by the National Science Foundation, National Natural Science Foundation of China and China Ministry of Science and Technology.