



中心系列讲座 ICQM Weekly Seminar Series
“Emergent interfaces of complex oxides: a new playground for memory and field effect devices”

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Venue: Room 607, Conference Room A, Science Building 5

地点: 理科五号楼607会议室

Abstract

The rich physics in complex oxides as a result of strong correlations between charge, spin, orbital and lattice produces novel collective electronic states, such as high-temperature superconductivity and colossal magnetoresistance. In heterostructures, we can explore even more opportunities due to the emergent interface-based phenomena based on charge transfer, spin exchange, ionic migration and so on. At the same time, unraveling the physics in such quantum materials requires complementary theoretical insights as well as rational synthesis with precise controls on interface stoichiometry and defect. In particular, the discovery of a two-dimensional electron system at the interface between two oxide insulators LaAlO₃ (LAO) and SrTiO₃ (STO) has launched intensive investigations and it has been subject to speculation, hypothesis and scrutiny for the past a few years. In this talk, I will discuss the most recent efforts in my group of building interface-based nonvolatile resistive switching device in “digitally” synthesized heterostructures grown using MBE-like pulsed laser deposition. Our experiments and first-principles calculations suggest a unique mechanism: The alteration of the electronic configuration at the LAO/STO interface and the creation of gap states within the LAO layer underpin the memory operation. I will also discuss our very recent results on the LAO/STO interface-based field effect device with an electric double layer as the top gate. These results shed lights on the possible manifestations of magnetic order, Kondo effect, and weak localization at the oxide interfaces. Future efforts with accelerated intensity are clearly needed to solve the complex jigsaw of future interface-based oxide nanoelectronics.

About the speaker

Dr. Wu received his Ph.D. from the University of Maryland, College Park in 2002, and B.S. from Zhejiang University in 1995. After working as a postdoc in Argonne National Laboratory, both in Materials Science Division and Center for Nanoscale Materials, he joined the faculty of Nanyang Technological University in 2006. His research group focuses on designing and synthesizing a wide range of oxide thin films, nanomaterials and heterostructures, exploring their emergent physical properties, and fabricating novel devices in the areas of spintronics, multiferroics, light emission, resistive switching memory, and field effect transistors.