



ICQM Informal Seminar

Visualization of Nanoscale Electronic Phases in Quantum Materials

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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

Complex quantum materials are characterized by their exotic phase diagrams, emergent physical phenomena, extreme electromagnetic properties, and enormous application potentials. In order to study the novel electronic phases inherently present in these systems, we have developed a scanning probe microscope to resolve the nanoscale dielectric properties. Using this technique, the colossal magnetoresistance effect in a manganite thin film is vividly demonstrated as a percolation transition. The observed orientation-ordered metallic network provides compelling evidence that the substrate strain plays the dominant role. In a second set of experiments, the microscope is utilized to map out the alternating metallic and insulating edge strips of aGaAs-based two-dimensional electron gas in the quantum Hall regime, as well as the topological conducting edges in the HgTe/CdTe quantum spin Hall system. Applications in multiferroic domain walls, phase change materials, and semiconductor devices will also be discussed. Continuous research on such a general-purpose electrical imaging tool is expected to make great impact across many disciplines in science and engineering.

About the Speaker

Keji Lai got his bachelor's degree in 2001 at Tsinghua University and did his Ph.D. research in Prof. Daniel C. Tsui's group at Princeton University. His main research topic during the Ph.D. program was on Magnetotransport Properties of 2D Electrons in Si/SiGe Heterostructures. Now he is a postdoc in Prof. Zhi-Xun Shen's group at Stanford University. His research interest here is to develop a scanning Microwave Impedance Microscope and study the microscopic electronic properties of complex materials. He is also interested in the electrical and thermal properties of the newly discovered topological insulators.