凝聚态物理学术报告

Visualizing cross-coupled orders in multiferroics using scanning probe microscopies

Prof. Weida Wu

Department of Physics, Rutgers University

时间地点：5 月 15 日，周五，上午 10:30，物理系三楼报告厅

Abstract： Multiferroics are materials with coexisting magnetic and ferroelectric orders. The cross-coupling between two ferroic orders can result in strong magnetoelectric coupling. Therefore, it is of both fundamental and technological interest to visualize cross-coupled topological defects in multiferroics. Indeed, topological defects with six interlocked structural antiphase and ferroelectric domains merging into a vortex core were revealed in multiferroic hexagonal manganites. Numerous vortices are found to form an intriguing self-organized network, and may be used to test Kibble-Zurek model of early universe. Many emergent phenomena, such as enhanced conduction and unusual piezoelectric response, were observed in charged ferroelectric domain walls protected by these topological defects. In particular, alternating uncompensated magnetic moments were discovered at coupled structural antiphase and ferroelectric domain walls in hexagonal manganites using cryogenic magnetic force microscopy (MFM), which demonstrates the coupling between ferroelectric and magnetic orders. Using a newly-developed Magnetoelectric Force Microscopy (MeFM), which combines MFM with *in-situ* modulating high electric fields, we directly visualize the magnetoelectric response of the multiferroic domains in hexagonal manganites. Our MeFM results reveal a giant enhancement of magnetoelectric response of a lattice mediated magnetoelectric effect near a spin-reorientation critical point. The direct visualization of magnetoelectric domains at mesoscopic scales opens up explorations of emergent phenomena in multifunctional materials with multiple coupled orders.

CV：Prof. Weida Wu is associate professor at the Department of Physics and Astronomy at Rutgers University. He received his BS degree from University of Science and Technology of China in 1998, MS from Northwestern University in 1999, and Ph.D. in Physics from Princeton University in 2004. He did post-doc at University of Texas at Austin in 2004-2006. He joined Rutgers University as research assistant professor in 2006-2007, assistant professor in 2007-2012, and associate professor since 2013. Prof. Wu's research focuses on a broad range of correlated phenomena, including multiferroics and magnetoelectrics, magnetic skyrmions, topological insulators, 2D materials, CMR manganites, hard magnets and etc. Prof. Wu received CAREER Award from NSF (2009) and Early Career Award from DOE (2011).