量子材料科学中心

International Center for Quantum Materials

Weekly Seminar

Mechanism and manipulation of the emergent behaviors at oxide interfaces

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Time: 4:00 pm, April.24, 2013 (Wednesday)
时间： 2013年4月24日（周三）下午 4:00
Venue: Conference Room A (607), No. 5 Science Building
地点： 理科五号楼607会议室

Abstract

Unexpected and often exciting phenomena could be observed at the oxide interface, and we show that they could be understood and controlled. Oxide interfaces are home for many exciting novel phenomena. In this talk, I will show two examples on how one can engineer oxide thin films and interfaces with atomic precision, and understand their properties with transport and *in situ* angle resolved photoemission spectroscopy (ARPES) measurements.

1. The record of superconducting transition temperature (Tc) has long been 56 K for the iron-based high-temperature superconductors (Fe-HTS's). Recently, in single layer FeSe films grown on SrTiO3 substrate, signs for a new 65 K Tc record are reported. Here with *in situ* photoemission measurements, we substantiate the presence of spin density wave (SDW) in FeSe films, a key ingredient of Fe-HTS that was missed in FeSe before, which weakens with increased thickness or reduced strain. We demonstrate that the superconductivity occurs when the electrons transferred from the oxygen-vacant substrate suppress the otherwise most pronounced SDW in single layer FeSe. Besides providing a comprehensive understanding of FeSe films and directions to further enhance its Tc, we establish the phase diagram of FeSe vs. lattice constant that contains all the essential physics of Fe-HTS's. With the simplest structure, cleanest composition and single tuning parameter, it is ideal for testing theories of Fe-HTS's. (S.Y. Tan *et al.*, ArXiv:1301.2748, *Nature Materials* (accepted))

2. As a colossal magneto-resistance material, La0.67Sr0.33MnO3(LSMO) has a Curie temperature above room temperature and was suggested to be 100% spin polarized. Its promising application in spintronic/electronic devices has aroused extensive studies on fabrication and properties of LSMO thin films. However, the so-called dead-layer, a critical thickness below which the metallic and ferromagnetic behaviors are suppressed, presents as a main obstacle for improving device performance. Here we report our work of tuning the properties of LSMO ultra-thin film around dead-layer thickness by changing the doping at the interfacial atomic layer. Using ozone-assisted molecular beam epitaxy (OMBE) system, high quality LSMO thin films are fabricated with precise doping control of each atomic layer on SrTiO3 substrate. We found that increasing strontium doping at the interfacial atomic layer enhances the metallic and ferromagnetic behavior of LSMO films around the critical thickness. The crucial role of interface is confirmed by comparing samples with Sr-enrichment at different positions. Our results show the importance of the interface to the dead-layer behavior, and suggest a possible way to improve device performance. (R. Peng *et al.*, ArXiv:1301.4822)

About the Speaker

封东来，复旦大学物理系浩清讲席教授、博导，应用表面物理国家重点实验室主任。一直从事超导和有序体系等复杂量子材料的电子结构研究，在铜氧化物高温超导、 铁基超导、电荷密度波、氧化物薄膜和异质结等的电子结构和微观机理方面做出了系统工作。还发展了光电子能谱，x光散射，氧化物分子束外延等实验技术。共发表论文80多篇，包括Science和Nature/materials/physics9篇，《物理评论快报》20篇，被引3900多次。在国际学术会议上做大会和邀请报告60余次，并任多个国际学术期刊编委和系列国际会议主席、组委。曾获联合国教科文组织青年科学家奖， 海外华人物理学会亚洲成就奖，中国物理学会叶企孙奖等奖项。

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