Seminar

Ultrathin Pb Films in a Magnetic Field: New Physics from an Old Superconductor

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Time: 4:00pm, Oct. 2014(Monday)
时间：2014年10月20日 （周一）下午4:00
Venue: Room 607, Conference Room A , Science Building 5
地点：理科五号楼607会议室

Abstract

Even in materials where the origin of superconductivity is known to be conventional, dimensional confinement, disorder, electron correlation, external magnetic field, and magnetic impurities often combine to induce novel electronic phases and quantum phase transitions, many of which remain poorly understood and controversial. We have carried out a detailed examination of the superconductivity and superconductor-insulator transitions in ultrathin amorphous Pb films as functions of disorder, magnetic field, and paramagnetic pair-breaking. The Pb films are grown via quench-condensation in a modified dilution refrigerator under ultrahigh vacuum at low temperature, and all the electrical measurements are performed *in situ*. Here I describe and discuss two intriguing observations from these experiments: i) A perpendicular magnetic field induces features suggestive of mesoscale phase separation near the critical field and an insulating state with localized superconductivity.[1] ii) In the same films, a parallel magnetic field is found to *enhance* superconductivity, increasing the mean-field Tc by as much as 13% in field as high as 8 T. The Tc enhancement is progressively suppressed, eventually eliminated, by incremental deposition of magnetic impurity on the film.[2]

[1] J.S. Parker, D. Read, A. Kumar, and P. Xiong, Europhys. Lett. 75, 950 (2006).
[2] H.J. Gardner, A.S. Kumar, L. Yu, P. Xiong, M. Warusawithana, L. Wang, O. Vafek, D.G. Schlom, Nature Physics 7, 895 (2011).

About the Speaker

Peng Xiong graduated with a B.Sc. in Physics from University of Science and Technology of China in July 1987. He received his Ph.D in Physics from Brown University in September 1993, with a thesis covering topics of high temperature superconductivity, magnetic granular solids, and mesoscopic superconductivity. He then spent the next four years as a postdoctoral fellow at the University of California at San Diego, performing research in superconductor-insulator transition and fluctuation effects in two- and one-dimensional systems. He joined the Physics faculty of the Florida State University in November of 1997. He is a member of the Integrative NanoScience Institute (INSI) at FSU. He was a recipient of the Alfred P. Sloan Research Fellowship (1998), University Teaching Award (FSU, 2003), PAI Award for Excellence in Research and Teaching (FSU, 2004), and Developing Scholar Award (FSU, 2007). He was elected a fellow of the American Physical Society in 2012.