TcSUH Bi-Weekly Seminar

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Effects of Single-Atom Impurities on Iron-based Superconductivity

ABSTRACT
Impurities can break Cooper-pairs into quasi-particles with energy states inside the superconducting gap. The characteristics of such in-gap states reflect, accordingly, the properties of the superconducting ground state. Therefore, impurity effects in superconductors have always been important subjects in the fundamental study of superconductivity. A single-atom impurity is an ideal model for both experimental and theoretical study of impurity effects on superconductivity. With high resolution STM/S technique, such proposal has been successfully realized. I will first briefly review a couple of examples applied to conventional and unconventional superconductors to illustrate the development of such approach. Then I will present some of our experimental results of single-atom impurity effects on iron-based superconductivity. I will show that, in Fe(Se,Te), an individual excess iron impurity atom destroys superconductivity only in a very local region, but induces a zero-energy bound state at the impurity site, which bears all the characteristics of the Majorana bound state proposed for topological superconductors. Globally, these excess iron impurity atoms destroy superconductivity in a manner beyond the successful "Swiss-cheese model". I will also show, on an atomic scale, the role of As atoms relate to superconductivity in $Ba_{1-x}K_xFe_2As_2$. Then I will discuss the implications of these results to the microscopic mechanism of iron-based superconductivity.

BIO
Dr. Shuheng H. Pan received his Ph.D. from The University of Texas at Austin in 1991 under the guidance of Prof. Alex de Lozanne. After conducting postdoctoral research at the University of Basel, Switzerland, he helped to establish the Microstructure Research Center, a National Research Laboratory, at the University of Hamburg, Germany. In 1995, he joined the Ultra Low Temperature Physics Group as a Research Associate at the University of California at Berkeley. In 1999, he became a faculty member of the Physics Department at Boston University. In 2001, he returned to Texas and became a faculty member of the Physics Department and a Principal Investigator at the Texas Center for Superconductivity at the University of Houston (TcSUH), where he conducts research on strongly correlated materials and novel superconductors with Scanning Tunneling Microscopy/Spectroscopy (STM/S).

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