世纪物理情·系列讲座

Doped Mott Insulator Perspective of High Tc Cuprate

【报告人】

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【摘要】

The physical mechanism of high temperature superconductivity in the cuprates remains an outstanding puzzle despite more than 30 years of intense research. One of the few consensuses is that the parent compound is a Mott insulator with strong onsite Coulomb repulsion, and superconductivity emerges when the doped charge carriers become mobile. A key task is thus to understand the electronic structure evolution of the doped Mott insulator. In this talk, we will report scanning tunneling microscopy studies of the atomic scale electronic structure of cuprates with varied doping levels. We will first show how the low energy electronic states emerge within the charge transfer gap when one hole and two holes are introduced into the parent compound. They can be regarded as hydrogen atom and molecule in a Mott insulator background. We then show how the pseudogap and charge order gradually develop with a few percent of uniformly doped holes. In particular, we find that a small energy gap reminiscent of the superconducting gap already exists in the insulating regime on charge puddles self-organized into a checkerboard pattern with 4a periodicity. Based on the observed trends, we hypothesize that the main change cross the insulator to superconductor phase boundary is the delocalization of local Cooper pairs. These results shed important new lights on the behavior of electrons in high Tc cuprates from the doped Mott insulator perspective.

【报告人简介】

Yayu Wang received his B.S. degree in physics from the University of Science and Technology of China in 1998 and Ph.D. from Princeton University in 2004. From 2004 and 2007 he was a Miller Research Fellow at UC Berkeley. After a brief visit to MIT, he joined the physics department of Tsinghua University in December 2007. His recent research interests include transport studies of topological quantum materials and STM studies of high temperature superconductors.

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