# 复旦大学物理系 Colloquium

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Location: C108, Jiangwan Physics Building（线下报告）

## The emergence and disappearance of superconductivity in cuprates

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**Abstract:** The mechanism of high Tc superconductivity in cuprates remains an outstanding puzzle despite more than 30 years of research. One of the few consensuses is that the parent compound is a Mott insulator, and superconductivity emerges when the doped holes suppress the antiferromagnetic order. However, superconductivity disappears in the strongly overdoped regime when too many holes are introduced. In this talk, we report scanning tunneling microscopy studies of the atomic scale electronic structure of cuprates from the doped Mott insulator perspective.

We first show the observation of charge transfer gap in the parent Mott insulator, and its anticorrelation with the maximum transition temperature. It implies that the superexchange interaction plays a central in mediating the Cooper pairing. When a few percent of holes are dispersed into the Mott insulator, they self-assemble into small islands of checkerboard consisting of plaquettes with size around 4a0. Even in the insulating sample, we observe the emergence of local superconducting pairing in small islands with checkerboard order. We find that each checkerboard plaquette contains approximately two holes, and exhibit stripy internal patterns that have strong influence on the superconducting properties. The global phase coherence is established when the spatial occupation of checkerboard plaquette exceeds a threshold. With further increase of doping into the overdoped regime, the strong quasiparticle scattering in the antinodal region causes pair breaking, which is the driving force for the vanishing of superconductivity. These results shed new lights on the emergence and disappearance of superconductivity in cuprates high Tc superconductors.

**个人简介：**1998年本科毕业于中国科技大学物理系，2004年在美国普林斯顿大学物理系获得博士学位，2004年至2007年在美国加州大学伯克利分校物理系做博士后。2007年12月加入清华大学物理系任教授至今。研究领域为凝聚态物理实验，近期的主要研究方向为拓扑量子体系的输运性质和高温超导体的扫描隧道显微学研究。