



PHYSICS COLLOQUIUM

Visualizing Pair Formation and the Riddle of High-Temperature Superconductivity



Ali Yazdani

Princeton University

Host: Chubukov

Abstract: The pairing of electrons underlies the formation of a superconducting state with zero electrical resistance. After twenty years of work, the mechanism of pairing and the temperature at which pairs first form in high-temperature copper-oxide superconductors are still hotly debated. Do pairs form at the critical temperature like conventional superconductors? Is pairing mediated by a bosonic excitation, as in conventional BCS superconductors, or is pairing with d-wave symmetry an unavoidable consequence of strong Coulomb repulsion in these compounds? In search of experimental answers to these important questions, we have developed several new techniques, based on the scanning tunneling microscope (STM), to visualize the process of pair formation on the atomic scale and to probe what controls the strength of pairing in these compounds with high precision. We show that pairing in the cuprates is strongly local, with pairs forming in nanoscale regions of samples over a range of temperatures above the critical temperature. I will discuss these experiments and other high resolution studies of electronic states in search of clues as to what controls the strength of the pairing interaction in the cuprates.

2241 Chamberlin Hall • Thursday, February 22, 2008 • 4:00 P.M.