Scanning Tunneling Spectroscopy and Vortex Imaging in the Iron-Pnictide High-T_c Superconductors

Last year, 22 years after the discovery of high-T_c superconductivity in the cuprates, superconductivity was discovered up to 55K in a second family of materials: the iron-pnictides. This new discovery has generated tremendous excitement for several reasons. First, there is hope that the iron-pnictides will finally provide the foil necessary to understand the enormous yet puzzling body of research on the cuprates. Second, initial reports of low anisotropy and strong vortex pinning in these new materials have spurred optimism that the iron-pnictides may finally lead to the widespread technological applications which have been elusive for cuprates. In this talk, I will summarize the current state of iron-pnictides research, before presenting our own work: the first scanning tunneling spectroscopic imaging study of a single crystal iron-pnictide superconductor in high magnetic fields. We study optimally doped $BaFe_{1.8}Co_{0.2}As_2$ with T_c =25.3K, finding a ~6 meV superconducting gap with nanoscale inhomogeneity, which leads to an average reduced gap of $2\overline{\Delta}/k_BT_c$~5.7. We further observe a static disordered vortex lattice at 9 T, and demonstrate that vortices are pinned in the bulk of this material, a promising observation for practical application.