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Scanning Tunneling Microscopy and Spectroscopy of Iron-Based Superconductors[1]

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Two decades after the discovery of high-T_c superconductivity in the cuprates, superconductivity was discovered up to 55 K in a second family of materials: the iron-pnictides. This recent 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, 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 present the first scanning tunneling spectroscopic imaging study of a single crystal iron-pnictide superconductor in high magnetic fields. We study optimally doped $BaCo_{0.2}Fe_{1.8}As_2$ with $T_c = 25.3$ K, finding a ~ 6 meV superconducting gap with nanoscale inhomogeneity, which leads to an average reduced gap of $2\Delta/k_BT_c \sim 5.7$. 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.

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