Gap structure of iron-pnictide superconductors from low-temperature heat transport

JEAN-PHILIPPE REID, University of Sherbrooke

The structure of the superconducting gap provides important clues on the symmetry of the order parameter and the pairing mechanism. Here I describe how measurements of the thermal conductivity at very low temperature can be used to determine whether nodes are present in the gap function of a particular superconductor, and how the application of a magnetic field probes the low-energy quasiparticle excitations. Measurements on hole-doped and electron-doped pnictide superconductors, Ba$_{1-x}$K$_x$Fe$_2$As$_2$ \cite{1} and Ba(Fe$_{1-x}$Co$_x$)$_2$As$_2$ \cite{2}, reveal a negligible residual linear term at $T\rightarrow0$, showing that the gap of these two superconductors has no nodes, at least in the basal plane. In both pnictides, a small field is found to be very effective in exciting quasiparticles, showing that the gap must be very small in some direction on the Fermi surface. In Ba(Fe$_{1-x}$Co$_x$)$_2$As$_2$, the evolution with doping $x$ is as follows: at low $x$, the gap is large everywhere on the Fermi surface, and beyond optimal doping the minimum gap becomes progressively smaller. I discuss what these features tell us about the nature of the superconducting state in pnictide superconductors. * Measurements of heat transport performed in collaboration with X.-G. Luo, H. Shakeripour, M.A. Tanatar, N. Doiron-Leyraud and L. Taillefer. \[1\] X.-G. Luo et al., Phys. Rev. B 80, 140503 (2009). \[2\] M.A. Tanatar et al., arXiv:0907.1276.