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Superconducting energy gap structure in KFe_2As_2 and $BaFe_2(As_{1-x}P_x)_2$

ANTONY CARRINGTON, University of Bristol

The k-space structure of the superconducting energy gap Δ in the iron-based materials is perhaps our best handle on the structure of the pairing interacting and hence the mechanism of superconductivity. Previous measurements have indicated that, unlike the cuprates, there is considerable variety in this structure between the different materials. In some Δ is almost isotropic whereas in other is it highly anisotropic and in a few case maybe nodal. However, there is still considerable controversy with different measurement techniques indicating different structures. Here I will discuss our measurement of magnetic penetration depth λ and specific heat C of the putative nodal materials KFe_2As_2 and $BaFe_2(As_{1-x}P_x)_2$. Measurements of the field dependence of λ are shown to be very useful for distinguishing the different pairing states, and we conclude that the best samples of KFe_2As_2 have a small but finite residual gap which may be impurity induced. For $BaFe_2(As_{1-x}P_x)_2$ we discuss some unusual features which appear when this material is tuned close the quantum critical point. I will discuss the significance of these for other superconductors close to a quantum critical point.