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Andreev reflection spectroscopy of iron-based superconductors

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After a reign of over two decades by the cuprate superconductors, several new families of iron-based high-temperature superconductors have recently been discovered. Essential to a superconductor is the nature of the superconducting gap, its value, its structure, and its temperature dependence. Point contact Andreev reflection (PCAR) spectroscopy operating in the ballistic limit is one of few techniques that can quantitatively measure the gap of these new Fe-based superconductors and its temperature dependence. In $\text{SmFeAsO}_{1-x}\text{F}_x$ ($0.15 \leq x \leq 0.30$), we have determined a single gap $2\Delta/k_B T_C \approx 3.5\text{-}3.6$ close to the BCS s-wave prediction and with a BCS-like temperature dependence.¹ These results will be compared with various theoretical possibilities and those obtained by other measurements, such as ARPES and penetration depth. While the principles of the PCAR spectroscopy are well established, poor contact control and ballistic heating might lead to the appearance of spurious gaps and pseudogaps in PCAR measurements. In collaboration with T. Y. Chen, S. X. Huang and Z. Tesanovic at JHU and R. H. Liu and X. H. Chen at USTC.

¹T. Y. Chen, Z. Tesanovic, R. H. Liu, X. H. Chen, and C. L. Chien, *Nature*, **453**, 1224 (2008)