



THE CHINESE UNIVERSITY OF HONG KONG
Department of Physics
COLLOQUIUM

Mind the Gap of Fe Superconductors

by

Dr. Tingyong CHEN (陳庭勇博士)
Department of Physics and Astronomy
The Johns Hopkins University, USA

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Time: 4:00 - 5:00 p.m.

Place: L1, Science Centre, CUHK

(Light refreshments will be served 20 minutes prior to the colloquium.)

ALL INTERESTED ARE WELCOME

Abstract

A family of new Fe superconductors (SC), including $\text{SmFeAsO}_{1-x}\text{F}_x$ (the “1111”), $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ (the “122”) and others, have been discovered in 2008 that contain the puckered FeAs planes instead of the hallmark CuO_2 planes in the well-known high T_C cuprate superconductors. Central to any superconductor is the nature of its superconducting gap, its value, its structure if any, and its temperature dependence. We used Andreev reflection spectroscopy to investigate the gap of the “1111” Fe-SCs and its temperature dependence¹. In the Fe-SCs, we found a nearly isotropic gap, or s -wave gap, with a BCS-like temperature dependence, completely different from the d -wave gap observed in the cuprate SCs. While the gap values (2Δ) and transition temperatures (T_C) are different for the Fe SCs with different F doping level, the value of $2\Delta/k_B T_C \approx 3.5$, the well known BCS result for s -wave superconductor. Our conclusion has since been corroborated by many other measurements, including Andreev reflection, penetration depth, ARPES, NMR relaxation time, and tunnel junctions. Neither did we find evidences of pseudogaps in the Fe-SCs, although the spin density wave transition can induce conductance results that may be mistaken as “pseudogaps”. These characteristics of the Fe superconductors are dramatically different from those of the cuprate superconductors.

¹T. Y. Chen, Z. Tesanovic, R. H. Liu, X. H. Chen, and C. L. Chien, “A BCS-like gap in the superconducting $\text{SmFeAsO}_{0.85}\text{F}_{0.15}$,” *Nature*, **453**, 1224 (2008).