世纪物理情·系列讲座

Scaling of the strange-metal scattering in high-Tc superconductors

【摘要】

Soon after the discovery of cuprate superconductors, the strange-metal behavior of their normal-state resistivity was observed, namely, a linear resistivity as a function of temperature (T-linear resistivity) persisting much lower than the Debye temperature. About one decade ago, several groups unveiled an intimated correlation between the superconducting transition temperature (Tc) and the slope of the T-linear resistivity (A1). That is, these two quantities increase or decrease simultaneously. Consequently, the question the community has been after is: what connects the strength of superconductivity with electron scattering? To solve this issue, one needs to quantify the relationship between Tc and A1. However, it turns out to be a great challenge to manipulate external parameters for marked evolution of properties with minute changes. In this talk, I would like to share with you two pieces of our recent work and report on the discovery of Tc ~ A10.5 relationship in different families of high-temperature superconductors. For a cuprate system La2-xCexCuO4, we developed advanced high-throughput techniques and used a combinatorial library to map how superconducting properties and normal-state properties of the superconductor evolve with minute compositional variation (Δx) with unprecedented resolution and accuracy . We also achieved continuous evolution of superconductivity in ion-gated FeSe film via electric-field gating technique integrated with two-coil mutual inductance and electrical transport property measurements. Such relationship between Tc and A1 is at work for both systems, yet different techniques were employed to tune the superconductivity minutely. Remarkably, the scaling is seemingly satisfied also in hole-doped cuprate, as well as a class of organic superconductors via pressure tuning. This unexpected universal scale indicates that there is perhaps a common origin of superconductivity in unconventional superconductors.

【报告人简介】

Kui Jin is the group leader of SC2 team and the deputy director of National Lab for Superconductivity in Institute of Physics (IOP), Chinese Academy of Sciences. He got his B.S. degree from Wuhan University in 2003 and Ph.D. from IOP in 2008. From 2008 to 2012, he worked as a Research Associate in Department of Physics at University of Maryland, College Park, USA. Thereafter, he joined IOP and set up his team. Jin and his team have been devoted to investigating the mechanism of high-temperature superconductivity and solving relevant key scientific issues in practical applications.

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