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Decrease of pairing strength with underdoping in cuprate superconductors

JOHAN CHANG, EPFL, Lausanne, Switzerland

The transition temperature T_c of cuprate superconductors decreases at low hole doping p, but it is still unclear whether the pairing strength decreases or increases. Different interpretations of the pseudogap lead to opposite conclusions. Different estimates of the upper critical field H_{c2} are in sharp contradiction. In this talk, we resolve the latter contradiction by showing that superconducting fluctuations in the underdoped cuprate Eu-LSCO, measured via the Nernst effect, obey the theory of Gaussian fluctuations, as in conventional superconductors [1, 2]. The extracted critical field H_{c2} is small, and it dips at $p = 0.11$, showing that pairing strength is weak where stripe order is strong. In the archetypal cuprate superconductor YBCO, H_{c2} extracted from other measurements [3] has the same doping dependence, also with a minimum at $p = 0.11$, again where stripe order is present [4, 5]. We conclude that competing states such as stripe order weaken the pairing strength and this, rather than phase fluctuations, is the predominant cause for the low T_c of underdoped cuprates. Work done in collaboration with N. Doiron-Leyraud, E. Hassinger, J.-Ph. Reid, O. Cyr-Choinière, F. Laliberté, R. Daou, S. Pyon, T. Takayama, H. Takagi, and Louis Taillefer.

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