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Evolution of superconducting gap and metallic ground state in cuprates from transport

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We report on fundamental characteristics of the ground state of cuprates in the limit of T=0, for both normal and superconducting states, obtained from transport measurements on high-quality single crystals of YBCO and Tl-2201, as a function of hole concentration. The superconducting gap is extracted from thermal conductivity; it is found to scale with the superconducting transition temperature throughout the overdoped regime, with a gap-to-Tc ratio of 5 [1]. The normal state is accessed by suppressing superconductivity with magnetic fields up to 60 T and is characterized by the limiting behavior of its electrical resistivity; while carrier localization is observed in YBCO at low temperature for carrier concentrations p below 0.1 hole/planar Cu, at p=0.1 and above the material remains highly metallic down to T=0 [2]. This shows that the non-superconducting state of underdoped cuprates, deep in the pseudogap phase, is remarkably similar to that of strongly overdoped cuprates, e.g. at p=0.3. We compare these results with similar measurements on other cuprates and discuss their implication for our understanding of the cuprate phase diagram. [1] In collaboration with: D.G. Hawthorn, S.Y. Li, M. Sutherland, E. Boaknin, R.W. Hill, C. Proust, F. Ronning, M. Tanatar, J. Paglione, D. Peets, R. Liang, D.A. Bonn, W.N. Hardy, and N.N. Kolesnikov. [2] In collaboration with: C. Proust, M. Sutherland, N. Doiron- Leyraud, S.Y. Li, R. Liang, D.A. Bonn, W.N. Hardy, N.E. Hussey, S. Adachi, S. Tajima, J. Levallois, and M. Narbone.