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Pseudogap phase and superconducting fluctuation regime of the cuprate superconductors[1]

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The pseudogap phenomenon in the cuprates is one of the most investigated topics in the field of correlated materials. A related question is the extent to which superconducting fluctuation persist between the pseudogap temperature (T^*) and superconducting transition temperature (T_c). We have addressed this question by combining several experimental probes: planar dc-resistivity [1], microwave conductivity [2,3], and torque mangetometry [4]. dc-resistivity measurements in the simple tetragonal model compound $HgBa_2CuO_{4+\delta}$ [5], which features the highest T_c (97 K) among all single-layer cuprates, reveal four characteristic temperatures: T^*, coincident with the onset of novel $\mathbf{q}$=0 magnetic order revealed by neutron diffraction [6]; a second, lower pseudogap temperature T^{**} associated with a further rearrangement of the sates at the Fermi level; T', which marks the onset of superconducting fluctuations; and finally T_c. Notably, T' lies only 10-20 K above T_c and closely tracks the superconducting dome with doping. The superconducting fluctuation regime is further investigated by microwave conductivity and torque magnetometry, and these results confirm the latter conclusion. The results for $HgBa_2CuO_{4+\delta}$ are complemented by a comprehensive investigation of other cuprates ($La_{2-x}Sr_xCuO_4$, $YBa_2Cu_3O_{6+\delta}$, $Bi_2Sr_{2-z}La_zCuO_{6+\delta}$), which leads to new insights into the phase diagram of cuprate superconductors.

[1] N. Barišić *et al.*, *preprint.*
[2] M.S. Grbić *et al.*, *Phys. Rev. B* **80**, 094511 (2009).
[3] M.S. Grbić *et al.*, *Phys. Rev. B* **83**, 144508 (2011).
[4] G. Yu *et al.*, *preprint.*
[5] N. Barišić *et al.*, *Phys. Rev. B* **78**, 054518 (2008).
[6] Y. Li *et al.*, *Nature* **455**, 372 (2008).

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