Observation of two Andreev-like energy scales in $La_{2-x}Sr_xCuO_4$ superconductor/normal-metal/superconductor junctions (LT26)

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Conductance spectra measurements of highly transparent ramp-type junctions made of superconducting $La_{2-x}Sr_xCuO_4$ electrodes and non superconducting $La_{1.65}Sr_{0.35}CuO_4$ barrier are reported [1]. At low temperatures below T_c, these junctions have two prominent Andreev-like conductance peaks with clear steps at energies Δ_1 and Δ_2 with $\Delta_2 > 2\Delta_1$. No such peaks appear above T_c. The doping dependence at 2 K shows that both Δ_1 and Δ_2 scale roughly as T_c. Δ_1 is identified as the superconducting energy gap, while a few scenarios are proposed as for the origin of Δ_2. Among these scenarios, the pre formed pairs one is quite appealing due to the similarity of the present phase diagram of Δ_2 to the T_{onset} results of the Nernst measurements [2].

[1]G. Koren and T. Kirzhner, Phys. Rev. Lett. **106**, 017002 (2011).
[2]Yayu Wang, Lu Li and N. P. Ong, Phys. Rev. B **73**, 024510 (2006).