Doping-induced change in the interlayer transport mechanism of Bi-2212

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Analysis of zero-bias resistance

Characteristic features of intrinsic tunneling characteristics:
Peak, Hump, Crossing point

Below Tc:
the curves remain parallel, but the energy scale decreases

Above Tc:
the slope monotonically decreases with T, but the energy scale remains constant

Observation of the excess/negative quasiparticle resistance in the superconducting state

Conclusions

We observed a remarkable crossover at $T_c$ in interlayer transport of underdoped Bi-2212: from Thermal-Activation type at $T>T_c$ to Quantum Tunneling type at $T<T_c$.

Surprisingly, the crossover is most pronounced in UD-Bi2212 with smooth and featureless superconducting transition.

Our data indicate that not only the electronic structure, but also the c-axis transport mechanism changes with doping: from coherent and directional pair tunneling in overdoped, to progressively increasing pair contribution in underdoped Bi-2212.

The latter is apparent only in the phase coherent state at $T<T_c$, almost T-independent, and is consistent with multiple Andreev reflection mechanism of the interlayer transport.

Trivial TA behavior in the whole normal state $T>T_c$ (no gap, no angular dependence no fitting parameters); Is the c-axis Pseudogap a pairing gap?

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