A realistic spin fluctuation model for the pairing interaction in $YBCO_{6.6}$

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In order to make progress in a detailed understanding of the pairing mechanism in the high-T_c cuprates it is important to combine theoretical calculations with experimental data on the spin excitation spectrum and the electronic excitation spectrum. In conventional superconductors the combination of Migdal-Eliashberg theory with tunneling spectra and the phonon spectrum measured by inelastic neutron scattering (INS) has led to a convincing demonstration that pairing is mediated by phonons in these materials. Following a similar approach, in the present work we use recent experimental data of angular resolved photoemission spectroscopy (ARPES) and INS on the same single crystal of YBCO and combine them with a fully momentum and energy dependent selfconsistent theoretical calculation [1]. We show that the main characteristic structures of ARPES (kink and the peak-dip-hump feature) and the main structures in the INS spin excitation spectrum (resonance and hourglass shape) can be related with each other within a spin fluctuation exchange scenario. Our theoretical calculation provides a new interpretation of the ARPES kink and results in a high value of the superconducting transition temperature, showing that the experimentally observed spin excitation spectrum realistically can drive high-temperature superconductivity.

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