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Momentum Dependence of the Self-energy and Fluctuation Spectrum of Bi2212 from High Resolution Laser ARPES

HAN-YONG CHOI, JIN MO BOK, JAE HYUN YUN, SungKyunKwan University, WENTAO ZHANG, X.J. ZHOU, Chinese Academy of Sciences, C.M. VARMA, University of California, Riverside — We report deduction of the Eliashberg function $\alpha^2F(\theta,\omega)$ at energy ω and along momentum cuts at angles θ normal to the Fermi surface from the high resolution laser angle resolved photoemission spectroscopy on slightly underdoped Bi2212 in the normal and superconducting states. Our principle result is that despite the angle dependence of the extracted single-particle self-energy, the Eliashberg function in the normal state collapses onto a single function of ω independent of the angle. It has a peak around 0.05 eV, flattens out above 0.1 eV with the angle dependent cut-off. The cut-off energy is given by the intrinsic value of about 0.4 eV or the energy of the band bottom in direction θ, whichever is lower. These results are consistent only with fluctuation spectra which have the correlation length of the lattice constant or shorter. In the superconducting state, the deduced $\alpha^2F(\theta,\omega)$ exhibits a new peak around 0.015 eV in addition to the 0.05 eV peak and flat spectrum as in the normal state. Both peaks become enhanced as T is lowered or the angle moves away from the nodal direction. The implication of these findings is discussed.

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