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Quasiparticle excitation spectra in the doped 2D Hubbard model

YOSHIRO KAKEHASHI, PETER FULDE, Max-Planck-Institute for PKS — The 2D Hubbard model has been much investigated as the simplest model of the high-Tc cuprate. Nonetheless, the fundamental properties of single-particle excitations from the ground-state have not yet been discussed because of the limitations of the momentum and energy resolutions in the usual numerical techniques. We present here our results of calculations for the ground-state excitation spectra based on the self-consistent projection operator method which has high resolution in both momentum and energy. Calculated excitation spectra for the intermediate Coulomb interaction strength are consistent with those obtained by the QMC technique at finite temperatures from the underdoped region to the overdoped region. The results also verify the hole-like Fermi surface in the underdoped region and the electron-like Fermi surface in the overdoped region. Our approach is consistent with the marginal Fermi liquid (MFL) picture. We found that the MFL with localized Mott-Hubbard subband can persist up to several percent of the doping concentration, and changes with doping discontinously to the normal Fermi-liquid states with the collapse of the lower Hubbard bands. This justifies the violation of Luttinger's theorem in the underdoped region, which was suggested by many previous calculations.

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