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Spectral functions and high-energy kink in cuprates

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Anomalous properties of quasiparticles in cuprates, a system with strongly correlated electrons, are most directly probed by angle-resolved photoemission spectroscopy (ARPES). Recently, large attention has been devoted to the high-energy kink followed by a waterfall quite universally observed by ARPES in hole-doped cuprates. We show (1) that spectral functions within the extended t-J model appropriate for cuprates and evaluated using the finite-temperature diagonalization of small clusters, exhibit such a high-energy kink in single-particle dispersion. The kink and waterfall-like features persist up to large doping and to temperatures beyond J. Hence the origin can be generally attributed to strong correlations and incoherent hole propagation at large binding energies. In contrast, our analysis predicts that electron-doped cuprates do not exhibit such phenomenon in photoemission.

[1] M.M. Zemljič, P. Prelovšek, and T. Tohyama, Phys. Rev. Lett. 100, 036402 (2008).