Finite energy spectral function of an anisotropic 2D system of coupled Hubbard chains

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We study the crossover from the one-dimensional to the two-dimensional Hubbard model in the photoemission spectra of weakly coupled chains. The chains with on-site repulsion are treated using the spin-charge factorized wave function, that is known to provide an accurate description of the dynamics of the model in the strong coupling limit, while the hoppings between the chains are considered as a perturbation. We calculate the dynamical spectral function at all energies in the random-phase approximation, by resuming an infinite set of diagrams. Even though the hoppings drive the system from a fractionalized Luttinger-liquid-like system to a Fermi-liquid-like system at low energies, significant characteristics of the one-dimensional system remain in the two-dimensional system. Furthermore, we find that introducing (frustrating) hoppings beyond the nearest neighbor one, the interference effects increase the energy and momentum range of the one–dimensional character.