FERROMAGNETISM IN THE HUBBARD MODEL: ANALYTICAL APPROACHES AND THE MOMENT SUM RULE

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9.7 cm

The sum rule for the moments of the one-particle spectral density, $M_m = \int d\omega \, \omega^m A(\omega)$, is discussed for the single-band Hubbard model [1,2]. It is shown that respecting the sum rule up to the order $m = 3$ is conceptually important for a qualitatively correct description of the spin-dependent excitation spectrum in the strong-correlation regime. We consider several different analytical approximations based on equation-of-motion decouplings, alloy analogies, interpolation techniques, perturbative and diagrammatic approaches. The functional form of the respective self-energy is analyzed to test the compatibility with the moment sum rule.
Correlation functions and dynamical quantities are calculated numerically for the various approximation schemes. The results obtained are compared with each other and also with essentially exact results available for infinite-dimensional lattices. It turns out that the $m = 3$ moment is rather unimportant for the paramagnetic phase on the hyper-cubic lattice. Contrary, it decisively influences the magnetic phase boundary as well as the critical temperature for the ferromagnetic phase on an fcc-type lattice.

[1] M. Potthoff, T. Herrmann, W. Nolting, Eur. Phys. J. B **4**, 485 (1998).
[2] M. Potthoff, T. Herrmann, T. Wegner, W. Nolting, phys. stat. sol. (b) **210**, 199 (1998).

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