MAGNETIC AND SUPERCONDUCTING CORRELATIONS IN THE 2D HUBBARD MODEL

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The functional renormalization group (fRG) is an ideal tool for dealing with the hierarchy of energy scales and competition of different interactions in correlated electron systems. Starting point is an exact hierarchy of flow equations which yields the gradual evolution of the effective low-energy action from the microscopic model Hamiltonian as a function of a continuously decreasing energy cutoff. Truncated at one-loop level the fRG yields a systematic and unbiased weak coupling stability analysis, where the competition and mutual feedback of particle-particle and particle-hole channels is consistently taken into account. The latter channel drives in particular magnetic, the former superconducting correlations. For the weakly interacting 2D Hubbard model detailed information on the dominant low-energy effective interactions and correlations has been obtained from numerical solutions of the one-loop flow equations. These calculations conclusively established the existence of d-wave superconductivity in the 2D Hubbard model at weak coupling. In a regime with strong antiferromagnetic correlations the spectral function for single-particle excitations obtained from the two-loop self-energy exhibits pseudogap features near van Hove points or other hot spots on the Fermi surface.

9.7 cm

13.4 cm

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