PHASE DIAGRAMS OF THE EXTENDED HUBBARD MODEL WITH TRANSVERSE (XY-TYPE) SPIN-EXCHANGE INTERACTION

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9.7 cm

The ground state properties of the extended Hubbard model with transverse (XY-type) spin-exchange interaction (J_{ij}^{xy}) are studied. The case of ferromagnetic ($J_{ij}^{xy} > 0$) and antiferromagnetic ($J_{ij}^{xy} < 0$) exchange couplings are considered. The analysis of the model is performed for d-dimensional hypercubic lattices, including $d = 1$ and $d = \infty$, by means of the (broken symmetry) Hartree-Fock approximation and, for $d = \infty$, by the slave-boson mean-field method. Some rigorous results derived for the strong coupling regime of the model for $d = 1$ are also presented. At half filling the ground state phase diagram for $d = 1$ is shown to consist of ten different phases, including site and bond located antiferromagnetic (SDW) and charge density wave (CDW) states, ferromagnetic XY (F) state, the superconducting s-wave (SS) and p-wave (TS) states, as well as several mixed phases with coexisting site and bond orderings. For $d = \infty$ the corresponding diagram is simpler and consists of the phases involving exclusively site located orderings. The obtained phase diagram for $d = 1$ is in agreement with results of recent studies based on the continuum-limit approach and the density-matrix renormalization group method.

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