Analytical Approach for Investigation of Generalized Hubbard Model with Correlated Hopping and Low-Temperature Antiferromagnetism

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In this work the analysis of indirect interactions in narrow band materials connected both with charge transfer and the exchange between localized magnetic moments is done. Anion subsystem is described by the band theory Hamiltonian and Hubbard operators are used to describe the localized subsystem. The spectrum of conduction electrons of a narrow-band semiconductor in paramagnetic and antiferromagnetic phases for arbitrary value of electron concentration is investigated within the effective Hamiltonian approach. Forasmuch the effective integrals of the exchange interaction depend on the hybridization parameter, one obtains that in narrow band systems with high Neel temperature for antiferromagnets the conductivity is higher as well. At T=0 in absence of current carriers in both cation and anion subsystem the ferro- or antiferromagnetic ordering can be realized due to indirect (through anion subsystem) exchange interactions between localized magnetic moments. We argue that in systems with correlated hopping of electrons conditions for antiferromagnetic ordering onset are more favorable. Typical antiferromagnetic interaction is realized due to mechanism equivalent to delocalized indirect Anderson exchange. The region of electron concentrations in which antiferromagnetism is stable is substantially wider and Neel temperatures are much greater in presence of the correlated hopping which appear to be a decisive parameter in this case.