Electron transport in the model of narrow-band ferromagnet with double orbital degeneracy

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Orbital degeneracy of the energy levels can lead to some peculiarities of conductivity of strongly correlated electron system. It has been shown [1] that the form of non-perturbed density of states (DOS) determines the values of critical electron concentrations at which a spontaneous ferromagnetic order is realized in the system. In this work the influence of DOS form through the modification of kinetic energy and possibility of spontaneous ferromagnetic order stabilization on a static electrical conductivity and effective masses of current carriers is studied. Magnetic field effect on transport characteristics of Mott-Hubbard material with partially filled energy band and double orbital degeneracy is analyzed. Energy spectra obtained within the projection technique for Green function method are used for numerical calculation of the system magnetization and investigation of the concentration dependence of conductivity and effective masses. The external magnetic field is shown to cause a decrease of conductivity due to magnetic ordering. Concentration dependencies of static conductivity and effective masses are influenced substantially by the unperturbed DOS form. The renormalization of effective masses in the system is determined by two factors, namely the correlated hopping of electrons and the band narrowing factor. Effective masses of current carriers are essentially spin-dependent, causing the conductivity changes in the external magnetic field. In the weak field, for arbitrary electron concentration spin splitting caused by translational mechanism of ferromagnetic ordering is of notable magnitude. In the strong field regime, the main effect is the qualitative change of band narrowing factor concentration dependence, which can induce a shift of critical concentration value of conductivity type change. At intermediate concentrations in almost quarterly filled band the sharp changes of effective masses and conductivity are possible due to pronounced competition of the studied factors.

1. L. Didukh and O. Kramar, Condens. Matter Phys. 547, **8** (2005).