Mean-Field Investigation of the Spin/Orbital Ordering in the Ground State of a Doubly Degenerate Hubbard Model

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Since the discovery of CMR manganese oxides, the orbital degree of freedom has been a key issue in understanding the physical properties of many transition metal oxide systems with orbital degeneracy. In addition to manganites, there are many companion systems such as titanates, vanadates, ruthenates, and molybdates, where the orbital degree of freedom plays an important role in determining their intriguing electronic properties: metal-insulator transitions, magnetic transitions, spin-/orbital-ordering, etc. As a step toward understanding the physics of orbitally degenerate correlated systems, we studied the ground state properties of a doubly degenerate orbital Hubbard model by employing the slave boson mean-field theory and the Green’s function method. The ground state energy and spin/orbital polarizations are investigated as functions of model parameters $t/U$ and $J_H/U$, where $t$ is an inter-site hopping amplitude, $U$, the on-site Coulomb interaction energy, and $J_H$, the Hund’s rule exchange coupling. The obtained results are compared with other theoretical and experimental results. The role of orbital degeneracy with $J_H$ is discussed.