Gutzwiller Approximation 1

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Determining properties of the ground state of a model is one of the most important problems in theoretical solid state physics. In this talk an approximative approach to the ground state energy of the Hubbard model is presented. Though originally developped by Gutzwiller, we will focus on the reformulation of Ogawa *et al.* Emphasis will be laid on the approach itself, results will only be provided in a formal way.

Given the ground state of the non-interacting Hubbard model, Gutzwiller's method accounts for the Coulomb repulsion by reducing the number of doubly occupied lattice sites. As a result, the expectation value of the kinetic energy decreases by a given factor, while the (in the thermodynamic limit) excactly treated interaction term is unaffected. The ground state is then approximated by minimalization of the energetic expectation values with respect to a variational parameter, which will be introduced in the approach.

In the second part, Gutzwiller approximation will be applied to the Periodic Anderson model - a two-band extension of the Hubbard model consisting of localized valence and extended conduction states. Hopping is allowed between these two levels and in the conduction band, Coulomb interaction exists in the valence level only and is assumed to act on-site. Hence, only the number of doubly occupied sites in the valence level will be reduced in our approach and the number of valence electrons will be fixed. A calculation similar to the one in the Hubbard model will lead to a renormalized level hopping term.

The renormalization factors in the Hubbard and the periodic Anderson model will be found to be identical. This amazing fact is due to the possibility of valence electrons hopping from one site to another via conduction band, where propagation is allowed.

Finally, we will investigate the dispersion relation in the periodic Anderson model by applying a Bogoliubov transformation and thus introducing quasiparticles.