DIAGRAMMATIC APPROACH FOR IMPURITY ANDERSON MODEL

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Impurity Anderson Model is the model for a system of conduction electrons that interact with a local spin as just another electrons in f – orbitals.

The Hamiltonian of the system contains hybridization interaction between band electrons and localized electrons. The last electrons have the Coulomb repulsion U and eigenvalue ϵ_f for the single f – electron. Therefore it is energetically unfavorable to have an up and down spin electrons both on the local orbital. The other important parameters of this model are the band width W and the conduction band density of states $\rho(\epsilon)$. There is also an energy parameter $\Gamma(\epsilon)$ associated with hybridization term which determines the width of the virtual level $\Gamma(\epsilon) = \pi V^2(\epsilon)\rho(\epsilon)$.

The Coulomb interaction of two localized electrons is far too large to be treated by perturbation theory and it must be included in non interacting part of the Hamiltonian. Including this term invalidates Wick theorem for local electrons and makes problems in doing the Green's function expansion (see papers [1, 2, 3]).

We propose a new approach to solving the Anderson model and as a new Wick theorem is used the definition of the Kubo cumulants of impurity electrons, named as irreducible Green's functions. For conduction electron subsystem the ordinary Wick theorem is available. The thermodynamic perturbation theory for Matsubara Green's functions has been elaborated considering the hybridization term of the Hamiltonian as a perturbation one of two subsystems of independent conduction and impurity electrons. The first of them are free but second one is strongly correlated.

The renormalized propagators for conduction electrons, impurity electrons and mixted ones have been analyzed. We have proved the linked cluster theorem for average value of the evolution operator $U(\beta)$ and free energy F of the system has been obtained.

The correlation function for strongly correlated electrons has been introduced and Dyson type equations for one-particle propagators have been formulated.

References

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