論文内容の要旨

論文題目 Charge ordering and Superconductivity in Organic Conductors
(有機導体における電荷秩序と超伝導)

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Charge ordering (CO) and superconductivity are found in many organic materials and the electron correlation effects are considered to have an important role for their origin. In this thesis, we have studied CO phase transition and superconductivity near CO instability with the emphasis on the effects of fluctuation.

In the first part of the thesis, we investigate the behavior of spin degrees of freedom near CO in one and two-dimensional systems. In one-dimension, we study extended Hubbard model which includes both on-site (U) and off-site (V) Coulomb interactions at $T = 0$. By using the spin-charge factorized wave function in $U \to \infty$ limit and numerical exact diagonalization method, spin susceptibility χ are calculated in a strongly correlated regime. It is found that χ is enhanced by the effect of V. Furthermore, χ has no detectable anomaly at CO transition point, because of the Berezinskii-Kosterlitz-Thouless (BKT) type transition of CO. In two-dimensional systems, we investigate CO transition at finite temperature by using Quantum Monte Carlo simulation. First, we estimate T_c of CO transition and examine the universality class by using the critical

exponents of two-dimensional ising model. Then, we calculate the temperature dependence of χ. It is found that χ is enhanced by V and it smoothly varies through a development of CO instability as in the one-dimensional case. These results mean that the charge fluctuation play important roles around the transition point and CO has little effect on the spin degrees of freedom.

In the second part of the thesis, we study the possibility of superconductivity close to CO in organic conductors such as θ-$(ET)_2X$ and $(TMTSF)_2X$. By using random phase approximation and perturbation theory, pairing symmetries are investigated under the coexistence of spin and charge fluctuations in relevant extended Hubbard models. It is found that f-wave triplet pairing is favored for both cases when charge fluctuation dominates. The stability of the pairing states are interpreted by the long range nature of Coulomb interactions and geometry of the Fermi surface.