Path-integral theory on the angle-resolved photoemission spectra of the interacting electron systems

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We will clarify how the electron correlations affect the angle-resolved photoemission spectra (ARPES), by using the quantum Monte Carlo simulation of the path-integral form. In the weak interaction regime, the density of states (DOS) has a multi-peak structure, which consists of a sharp one-body coherent component and a broad many-body incoherent component. We will show that a short-range spin correlation causes such a multi-peak structure in the DOS [1]. In the ARPES, as shown in Figs.1 and 2, the binding energy-dependence of the peak width is qualitatively explained within the random phase approximation near the Fermi level, which also indicates the large coherent component in the weakly correlated systems. On the other hand, as the electronic interaction increases, the ARPES is dominated by the many-body incoherent component even near the Fermi level. It will be shown that the strong coupling between the collective spin excitations and photo-generated hole causes the incoherent component [2]. Then, I will try to explain the experimentally observed ARPES of the 1-D copper-oxide and Ni complex within the framework of the Hubbard and extended Hubbard models.

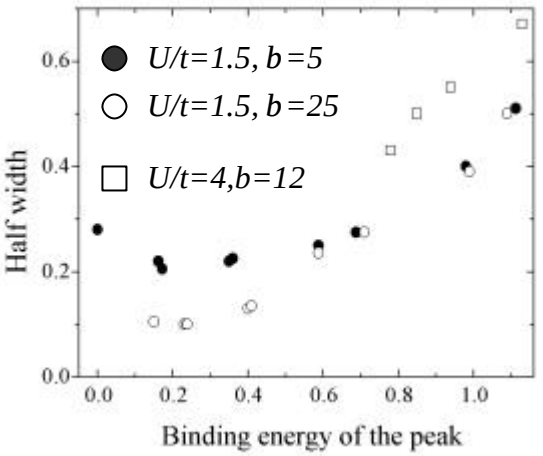

Figure 1

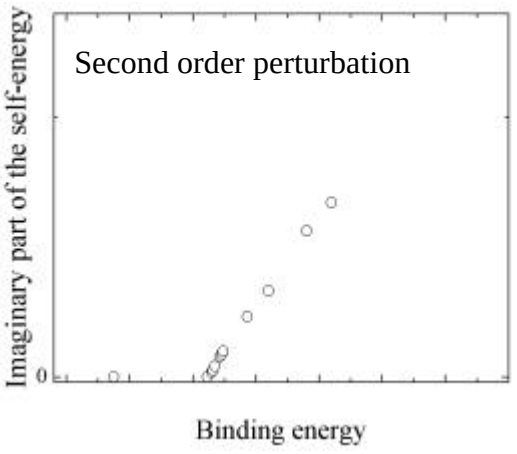

Figure 2

[1] N. Tomita, M. Yamazaki and K. Nasu, Phys. Rev. B68(2003)035117.
[2] N. Tomita and K. Nasu, Phys. Rev. B60(1999)8602.