23BG012, 23BU010 BL-9A, IPES

Effects of Quantum Charge Fluctuations on the Electron Self-energy of High–T_c Cuprate Superconductors Using Angle-Resolved Photoemission and Inverse Photoemission Spectroscopies

Y. Onishi[a], Y. Miyai[a], Y. Tsubota[a], K. Tanaka[c], S. Ishida[d], H. Eisaki[d], H. Sato[b], M. Arita[b], K. Shimada[a,b], and S. Ideta[a,b]

[a] *Graduate School of Advanced Science and Engineering, Hiroshima Univ., Higashi-Hiroshima 739-0046, Japan*
[b] *Hiroshima Synchrotron Radiation Center (HiSOR), Hiroshima Univ., Higashi-Hiroshima 739-0046, Japan*
[c] *UVSOR-Ⅲ Synchrotron, Institute for Molecular Science, Okazaki, Aichi 444-8585, Japan*
[d] *National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki 305-8560, Japan*

Keywords: high- T_c superconductors, ARPES, IPES, charge fluctuations, electronic structure

In the previous studies of angle-resolved photoemission spectroscopy (ARPES), it has been reported that kink structures are observed in the electronic structure for the cuprates likely due to spin fluctuations and/or phonons [1-3]. This observation indicates that the glue of the Cooper pair is magnons or phonons. On the other hand, in recent years, resonant inelastic x-ray scattering experiments have been performed in the hole- and electron-doped high-T_c cuprate superconductors and charge excitations are observed [4 ,5]. In addition, theoretical calculations of unconventional high-T_c superconductors using the layered *t-J* model, which includes the long- and short-range Coulomb interactions with charge fluctuations, have been reported to study how charge fluctuations interact to the electronic structure in cuprates [6, 7]. However, the effect of charge fluctuations to the electronic structure of cuprates has not been studied by angle-resolved photoemission spectroscopy (ARPES) directly.

In this study, to investigate the role of charge fluctuations for the electronic structure in the high-T_c cuprate superconductor, $Bi_2Sr_{1.6}La_{0.4}CuO_{6+\delta}$ (Bi2201), we have performed ARPES and inverse photoemission spectroscopy (IPES) to study the occupied and unoccupied states, respectively. In the experiments, ARPES and IPES measurements are performed along high-symmetry lines in the Brillouin zone (Fig. 1, (a)). We found the shoulder structure near 1 eV above the Fermi level in the IPES spectra as shown by red area in Fig. 1 (b). In the poster presentation, we will show the details of the electronic structure on Bi2201 in the occupied and unoccupied states and discuss the effect of charge fluctuations on the electronic structure of high-T_c cuprate superconductors, including a comparison with theoretical calculations [6, 7].

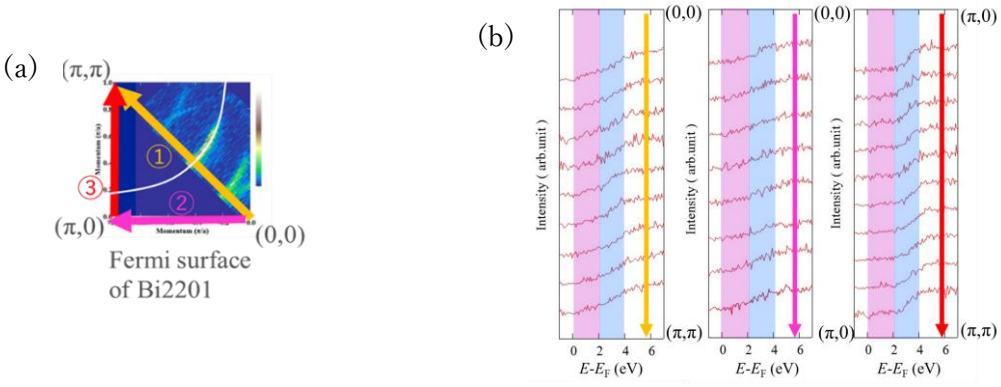

FIGURE 1. (a) The Fermi-surface on the Brillouin zone for Bi2201. Each arrow corresponds to the arrow in the panel (b). (b) Energy-distribution curves in the second Brillouin zone (T = 13K, E_{kin} = 50eV).

REFERENCES

1. A. Lanzara *et al*., Nature **412**, 510 (2001).
2. P. V. Bogdanov *et al*., Phys. Rev. Lett. **85**, 2581 (2000).
3. S. M. Hayden *et al*., Nature **429**, 531–534 (2004).
4. K. Ishii *et al*., Phys. Rev. B **96**, 115148 (2017).
5. A. Singh *et al*., Phys. Rev. B. **123**, 235105 (2022).
6. H. Yamase *et al*., Phys. Rev. B **104**, 045141 (2021).
7. H. Yamase *et al*., Commun Phys **6**, 168 (2023).