Hybridization of the Electronic Structure in Triple-layer High-T_c Cuprate Bi2223 Observed by ARPES

S. Ideta[a,b], S. Johnston[c], T. Yoshida[d], K. Tanaka[b], M. Mori[e], H. Anzai[f], A. Ino[a,g], M. Arita[a], H. Namatame[a], M. Taniguchi[a], S. Ishida[h], K. Takashima[l], K. M. Kojima[k], T. P. Devereaux[i], S. Uchida[h,l], and A. Fujimori[l,m]

[a] *Hiroshima Synchrotron Radiation Center, Hiroshima University, Higashi-Hiroshima 739-0046, Japan*
[b] *Institute for Molecular Science, UVSOR-III Synchrotron Okazaki, 444-8585, Japan*
[c] *Department of Physics and Astronomy, The University of Tennessee, Knoxville, Tennessee 37996, USA*
[d] *Department of Human and Environmental studies, Kyoto University, Sakyo-ku, Kyoto 606-8501, Japan*
[e] *Advanced Science Research Center, Japan Atomic Energy Agency, Tokai 319-1195, Japan*
[f] *Graduate School of Engineering, Osaka Prefecture University, Sakai 599-8531, Japan*
[g] *Department of Education and Creation Engineering, Kurume Institute of Technology, Fukuoka 2286-66, Japan*
[h] *National Institute of Advanced Industrial Science and Technology, Tsukuba, Ibaraki 305-8568, Japan*
[i] *Geballe Laboratory for Advanced Materials, Stanford University, Stanford, California 94305, USA Menlo Park, California 94025, USA*
[j] *National Institute of Advanced Industrial Science and Technology, Tsukuba, Ibaraki 305-8568, Japan*
[k] *Centre for Molecular and Materials Science, TRIUMF, 4004 Vancouver, Canada*
[l] *Department of Physics, University of Tokyo, Bunkyo-ku, Tokyo 113-0033, Japan*
[m] *Department of Applied Physics, Waseda University, Shinjuku-ku, Tokyo 169-8555, Japan*

Keywords: Superconductivity, Cuprate, ARPES, Electronic structure.

The energy gap seen in the superconducting (SC) and normal states has been believed to be an important piece of evidence for the mechanism of high SC transition temperature in cuprate superconductors. Bi-based high-T_c cuprate superconductors can be classified by the number of the neighboring CuO_2 planes (n): single-layer (n = 1) $Bi_2Sr_2CuO_{4+\delta}$ (Bi2201), double-layer (n = 2) $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi2212), triple-layer (n = 3) $Bi_2Sr_2Ca_2Cu_3O_{10+\delta}$ (Bi2223). In going from n = 1 to 3, the maximum T_c increases: It is 35 K and 95 K for Bi2201 and Bi2212, respectively, and reaches 110 K for Bi2223, which is the highest T_c among the Bi family of cuprates [1]. However, the microscopic origin of this trend has not been clarified yet.

For optimally doped Bi2223, we have revealed the electronic structure using angle-resolved photoemission spectroscopy (ARPES) [2-4]. In the present study, we have performed a high-resolution ARPES study of Bi2223 using synchrotron radiation and observed hybridization between the CuO_2 planes, which shows that an anti-crossing energy gap opens around the off-nodal region. In this poster presentation, we will discuss a possible interpretation of hybridization of the electronic structure in the triple-layer cuprate superconductor and the origin of the high T_c [5].

REFERENCES

1. A. Iyo *et al.*, *J. Phys. Soc. Jpn.*, **76**, 094711 (2007).
2. S. Ideta et al., *Phys. Rev. Lett.* **104**, 227001 (2010).
3. S. Ideta et al., *Phys. Rev. B* **85**, 104515 (2012).
4. S. Kudo *et al.*, *Phys. Rev. B* **92**, 195135 (2015).
5. S. Ideta *et al.*, *Phys. Rev. Lett.* **127**, 217004 (2021).