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Recent Photoemission Results for the Electron-Doped Superconductors

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Recent improvement in the energy and angular resolution of angle-resolved photoemission spectroscopy (ARPES) enabled us to investigate the detailed electronic structure in electron-doped high-temperature superconductors (HTSC), which have a relatively smaller energy-scale of superconductivity compared to hole-doped systems. In this talk, we report our recent ARPES results[1,2] focusing on the many-body interaction and the superconducting-gap symmetry in electron-doped HTSC. We have performed high-resolution ARPES measurements on $Nd_{2-x}Ce_xCuO_4$ and observed that the quasiparticle (QP) effective mass around oπsg_p is strongly enhanced due to opening of an antiferromagnetic (AF) pseudogap. Both the QP effective mass and the AF pseudogap are strongly anisotropic with the largest magnitude near the hot spot, which is defined as an intersection point of the Fermi surface and the AF zone boundary. Temperature-dependent measurements have revealed that the AF pseudogap survives at temperatures much higher than T_N (Néel temperature), possibly due to the short-range AF correlation remaining even above T_N. The AF pseudogap gradually decreases with doping and is abruptly filled up near the boundary between the AF and superconducting phases. To study the anisotropy of superconducting gap in electron-doped HTSC, we have performed high-resolution ARPES on $Pr_{0.89}LaCe_{0.11}CuO_4$. We observed that the momentum dependence of superconducting gap is basically consistent with the$d_x2_{-y}2$–wave symmetry, but it obviously deviates from the simple $d_x2_{-y}2$ gap function. The maximum superconducting gap is not observed at the zone boundary as expected from the simple $d_x2_{-y}2$ gap symmetry, but it is located around the hot spot where electrons are thought to be strongly coupled to the AF spin fluctuation. All these ARPES results suggest that the electronic stricture and the superconducting behavior are strongly dominated by the AF interaction in electron-doped HTSC. 1) H. Matsui, K. Terashima, T. Sato, T. Takahashi, S.-C. Wang, H.-B. Yang, H. Ding, T. Uefuji, and K. Yamada, Phys. Rev. Lett. **94** (2005) 047005. 2) H. Matsui, K. Terashima, T. Sato, T. Takahashi, M. Fujita and K. Yamada, Phys. Rev. Lett. **95** (2005) 017003.