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Laser ARPES study of optimally doped $FeTe_{0.6}Se_{0.4}$ KOZO OKAZAKI, YOSHIAKI ITO, YUICHI OTA, YOSHINORI KOTANI, Institute for Solid State Physics, University of Tokyo, TAKAHIRO SHIMOJIMA, Department of Applied Physics, University of Tokyo, TAKAYUKI KISS, Graduate School of Engineering Science, Osaka University, SHUNTARO WATANABE, Research Institute for Science and Technology, Tokyo University of Science, CHUANGTIAN CHEN, Beijing Center for Crystal R&D, Chinese Academy of Science, SEIJI NIITAKA, TETSUO HANAGURI, HIDENORI TAKAGI, RIKEN Advanced Science Institute, ASHISH CHAINANI, RIKEN SPring-8 Center, SHIK SHIN, Institute for Solid State Physics, University of Tokyo — We have studied the electronic structure of optimally doped $FeTe_{0.6}Se_{0.4}$ (T_c = 14.5 K), using laser-excited angle-resolved photoemission spectroscopy (laser ARPES). We observe sharp superconducting coherence peaks in the hole band slightly shifted from the Γ point at T = 2.5 K. In contrast to earlier ARPES studies but consistent with thermodynamic results, the momentum dependence shows a $\cos(4\varphi)$ modulation of the SC-gap anisotropy. In addition, we found an electron band at the Γ point, lying just above E_F. This electron band also shows a sharp superconducting coherence peak with gap formation below T_c. The hole and electron bands show significantly different values of superconducting gap Δ and Fermi energy ϵ_F , while the associated Bogoliubov quasiparticle dispersions get merged. The results suggest composite superconductivity in an iron-based superconductor, consisting of strong-coupling Bose-Einstein condensation (BEC) in the electron band while the hole band superconductivity lies closer to the weak-coupling Bardeen-Cooper-Schrieffer (BCS) limit.

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