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Two orbital anaysis on the correlation between T_c and the Fermi surface shape in the cuprate superconductors H. SAKAKIBARA, K. SUZUKI, Dept. of Eng. Sci., The Univ. of Electro- Commun., H. USUI, Dept. of Phys., Osaka Univ., S. MIYAO, Dept. of Mat. Eng. Sci., Osaka Univ., I. MARUYAMA, Dept. of Info. and Sys. Eng., Fukuoka Inst. of Tech., K. KUSAKABE, Dept. of Mat. Eng. Sci., Osaka Univ., R. ARITA, Dept. of Appl. Phys., The Univ. of Tokyo, H. AOKI, Dept. of Phys., The Univ. of Tokyo, K. KUROKI, Dept. of Phys., Osaka Univ. — Correlation between the Fermi surface shape and T_c in the cuprates has been an issue of great interest. Experimentally, materials with more warped Fermi surfaces tend to have higher T_c. In our recent studies(PRL 105, 057003(2010)), we have given an explanation to this by considering a two-orbital model that explicitly takes account of the d_{z^2} orbital on top of the $d_{x^2-y^2}$ orbital. Namely, when the d_{z^2} orbital component mixes on the Fermi surface, d-wave pairing is degraded, while the Fermi surface becomes better nested. In our previous study, however, we had only one example of actual materials in which the d_{z^2} mixture is strong, i.e., La214. In order to show that T_c is indeed systematically correlated with the d_{z^2} mixture, we investigate further examples, namely, $Pb_2Sr_2Cu_2O_6$, $Pb_2Sr_2YCu_3O_8$ and $La_2CaCu_2O_6$, which have relatively low T_c and Fermi surfaces that are not strongly warped. Applying the fluctuation exchange approximation to the two-orbital model obtained for these materials, we show that the d_{z^2} mixture does indeed reduce T_c. Present result endorses our conclusion that the d_{z^2} orbital mixture is an important key factor for the material dependence of T_c in the cuprates.

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