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Effect of inter-layer single-electron hopping and pair-hopping on superconductivity in multi-layered cuprates KAZUTAKA NISHIGUCHI, Department of Physics, The University of Tokyo, KAZUHIKO KUROKI, Department of Applied Physics and Chemistry, The University of Electro-Communications, RYOTARO ARITA, Department of Applied Physics, The University of Tokyo, TAKASHI OKA, HIDEO AOKI, Department of Physics, The University of Tokyo
— The multi-layered cuprates, which remain the highest-Tc material to date, still harbor unsolved problems. Specifically, the reason why Tc increases as we go from the single-layer system to trilayer has not been microscopically understood. Here we have studied the superconductivity in the n-layered Hg-series cuprate $HgBa_2Ca_{n-1}Cu_nO_{2+2n+\delta}$ by solving the Eliashberg equation for a multi-orbital Hubbard model with the random phase approximation (RPA) as well as with the fluctuation exchange approximation (FLEX). The hopping parameters are obtained by downfolding from first principles calculations based on the density functional theory (DFT) for the Hg-series cuprates with n=1, 2, 3. The result indicates that the enhancement of Tc with n is not explained in terms of the band structure alone. We then consider the possible ingredients in multi-layered cuprates that may affect Tc for different numbers of CuO_2 planes, specifically, the inter-layer single-electron hopping and inter-layer Cooper-pair hopping originating from the inter-layer Coulomb interaction, which we vary to probe the superconducting nature.

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