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Crossover From Strong to Weak Pairing States in $t-J-U$ Model Studied by A Slave Spin Method WEI-CHENG LEE, Binghamton Univ — We investigate the superconductivity in the $t-J-U$ model within a slave-spin method. We show that the BCS mean-field theory implemented with the slave spin formalism naturally predicts two distinct gaps which are the pairing gap of the spinons $\Delta_{\rm f}$ and the Cooper pairing gap of the electrons $\Delta_{\rm SC} = {\rm Z}\Delta_{\rm f}$, where Z is the quasiparticle weight. If U exceeds the critical value for the Mott insulating state at half- filling, Z develops a strong doping dependence, leading to a doping-driven crossover from strong to weak pairing states. In the strong pairing state, while $\Delta_{\rm f}$ is enhanced as x $\rightarrow$ 0, $\Delta_{\rm SC} \sim$ x due to the renormalization of Z. In the weak pairing state, Z does not change with x significantly. Therefore, $\Delta_{\rm SC}$ is mainly controlled by $\Delta_{\rm f}$, and both of them go to zero at larger doping. The crossover from strong to weak pairing states is well captured by the slave spin formalism within reasonable range of parameters just at the mean-field level, indicating the slave spin formalism is a powerful tool to study correlated materials.

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