On the superconducting instabilities in the bilayer two-orbital Hubbard-Kanamori model of $La_3Ni_2O_7$

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The mechanism behind the high transition temperature superconductivity in the recently discovered bilayer nickelate $La_3Ni_2O_7$ is currently under heated debate. In this work, by employing cluster dynamical mean-field theory, we systematically investigate superconductivities in the bilayer two-orbital Hubbard - Kanamori model in the parameter regime relevant to pressurized $La_3Ni_2O_7$. We show that for small Hund's coupling and moderate hole concentration levels of the d_{z^2} orbital, a two-component superconductivity driven by d_{z^2} orbital spin correlations predominates. This superconducting instabilities rapidly vanishes as d_{z^2} orbital approaches half-filling, where another superconductivity that originates from spin correlations transferred from interlayer d_{z^2} orbitals to $d_{x^2-y^2}$ orbitals via Hund's coupling emerges. These two superconductivities have comparable maximum transition temperatures and are both of $S_\pm$ wave. We present phase diagrams analyzing the dependences of both superconductivities on various physical parameters, including the strength of Hund's coupling, the hybridization between d_{z^2} and $d_{x^2-y^2}$ orbitals, etc. We discuss implications of our results for experimental observations. We also explore the possible d-wave superconductivity in the system.

Key words: superconductivity; La3Ni2O7; dynamical mean-field theory