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Kinetic Energy Driven Superconductivity in the Electron Doped Cobaltate $Na_xCoO_2 \cdot yH_2O$

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Abstract: Within the charge-spin separation fermion-spin theory, we show that the mechanism of superconductivity in the electron doped cobaltate $Na_xCoO_2 \cdot yH_2O$ is ascribed to its kinetic energy. The dressed fermions interact occurring directly through the kinetic energy by exchanging magnetic excitations. This interaction leads to a net attractive force between dressed fermions, then the electron Cooper pairs originating from the dressed fermion pairing state are due to the charge-spin recombination, and their condensation reveals the superconducting ground state. The superconducting transition temperature is identical to the dressed fermion pair transition temperature, and is suppressed to a lower temperature due to the strong magnetic frustration. The optimal superconducting transition temperature occurs in the electron doping concentration $\delta \approx 0.29$, and then decreases for both underdoped and overdoped regimes, in qualitative agreement with the experimental results.

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