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Influence of long-range coulomb interaction and on-site hubbard repulsion on the formation of d-wave copper-pairing in High- Tc cuprates

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Abstract

We develop a diagram technique for the self-consistent treatment of the long-range Coulomb interaction and on-site Hubbard repulsion in the normal and superconducting state of high7-4 cuprates. The resultant analytical expression for the "screened" matrix elements taking into account long-range and on-site repulsion has been derived. In particular, it accounts for processes with and without spin-flip due to an exchange of spin and charge density fluctuations. Furthermore, we derive the expressions for the normal and anomalous self-energy parts near the superconducting transition temperature Tc that takes into account the vertex corrections including crossing diagrams. The contribution of the crossing parts is taken within the ladder approximation (similar to Fluctuation-Exchange approximation) where the role of Hubbard on-site interaction is replaced by the Coulomb matrix element with a spin-flip averaged over the momentum. Finally, the developed scheme allows to analyze the formation of d-wave superconductivity and its stability in presence of the long-range Coulomb repulsion within a self-consistent anisotropic Eliashberg-like approach. © 2004 Plenum Publishing Corporation.

Keywords

High-7-4 cuprates, Hubbard model, Long-range Coulomb repulsion