

Quasiparticle operators for high-temperature cuprate superconductors

Eremin M.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2017, Pleiades Publishing, Inc. A complete set of quasiparticle operators diagonalizing operators of the Coulomb and exchange interactions of copper and oxygen holes in cuprate high-temperature superconductors (HTSCs) is obtained. A scheme of energy bands in the regime of strong electron correlations is constructed. The effective operator for the singleband approximation is obtained with this scheme. It is found that the role of three-site correlations in hole HTSCs is negligibly small. This circumstance explains both the sharp increase in critical temperatures of hole HTSCs in comparison with electron-doped ones and the asymmetry between the spectra of collective spin excitations in these compounds.

<http://dx.doi.org/10.1134/S0021364017050071>

References

- [1] P. W. Anderson, *Science* 235, 1196 (1987).
- [2] V. J. Emery, *Phys. Rev. Lett.* 58, 2794 (1987)
- [3] V. J. Emery and G. Reiter, *Phys Rev. B* 38, 4547 (1988).
- [4] F. C. Zhang and T. M. Rice, *Phys. Rev. B* 37, 3759 (1988).
- [5] A. V. Chubukov, D. Pines, and J. Schmalian, in *Superconductivity, Vol. 2: Novel Superconductors*, Ed. by K. H. Bennemann and J. B. Katterson (Springer, Berlin, Heidelberg, 2008), p. 1349.
- [6] Ar. Abanov and A. V. Chubukov, *Phys Rev. Lett.* 84, 5608 (2000)
- [7] Ar. Abanov, A. V. Chubukov, and J. Schmalian, *Adv. Phys.* 52, 119 (2003).
- [8] A. F. Barabanov, L. A. Maksimov, and G. V. Uimin, *JETP Lett.* 47, 532 (1988), *Sov. Phys. JETP* 69, 371 (1989)
- [9] F. Barabanov, R. O. Kuzian, and L. A. Maksimov, *J. Phys.: Condens. Matter* 3, 9129 (1991).
- [10] V. V. Val'kov, T. A. Val'kova, D. M. Dzebisashvili, and S. G. Ovchinnikov, *JETP Lett.* 75, 378 (2002).
- [11] N. M. Plakida, *High-Temperature Cuprate Superconductors. Experiment, Theory, and Applications* (Springer, Berlin, Heidelberg, New York, Hong Kong, London, Milan, Paris, Tokyo, 2011).
- [12] M. V. Eremin, R. Markendorf, and S. V. Varlamov, *Solid State Commun.* 88, 15 (1993)
- [13] M. V. Eremin, S. Solov'yanov, S. V. Varlamov, D. Brinkman, M. Mali, R. Markendorf, and J. Roos, *JETP Lett.* 60, 125 (1994).
- [14] M. Eremin, S. Solovjanov, and S. Varlamov, *J. Phys. Chem. Solids* 56, 1713 (1995)
- [15] M. V. Eremin, S. G. Solov'yanov, and S. V. Varlamov, *J. Exp. Theor. Phys.* 85, 963 (1997).
- [16] N. M. Plakida, R. Hayn, and J.-L. Richard, *Phys. Rev. B* 51, 16599 (1995).
- [17] C. M. Varma, S. Schmitt-Rank, and E. Abrahams, *Solid State Commun.* 62, 681 (1987).
- [18] M. V. Eremin and M. A. Malakhov, *JETP Lett.* 104, 15 (2016).
- [19] N. M. Plakida and V. S. Oudovenko, *Phys. Rev. B* 59, 11949 (1999).
- [20] N. M. Plakida, L. Anton, S. Adam, and Gh. Adam, *J. Exp. Theor. Phys.* 97, 331 (2003).