Theoretical analysis of STM spectra in short coherence length superconductors

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The real space versions of the two component and two band model of high temperature superconductors (HTS) are solved with help of Bogolubov-de Gennes equations.

The disorder in the electron and boson subsystems of the two component model has been taken into account. It strongly modifies the superconducting properties and leads to local variations of the gap parameter and density of states. The assumption that the impurities mainly modify boson energies offers natural explanation of the puzzling positive correlation between position of the impurity and the value of the order parameter.

Our main assumption in the study of two orbital model is that the oxygen impurities in Bi family of HTS being a source of charge carriers are responsible for the appearance of negative U centers inducing superconductivity. The detailed study shows that the resulting model has a potential to describe some of the correlations observed in experiments. In particular, the short range superconducting interactions allow detailed study of local density of states at sites with $U < 0$ and U=0. It turns out that the density of states at sites with U=0 is characterised by small values of the gap and high, well pronounced coherence peaks, while at sites with $U < 0$ the gap is larger and the coherence peaks wider and lower in accordance with experimental data.

Acknowledgments: The work we are reporting on here has been partially supported by the grant no. N N202 1878 33.

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