Impurities and correlations in the boson-fermion model of superconductors

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The boson-fermion (BF) model of superconductivity formulated in the real space has been suplemented with the Hubbard term describing strong on-site electron-electron repulsion U. This term has been treated by the Gutzwiller approximation, while mean - field like decoupling has been used for boson-fermion coupling. The effect of random point-like impurities on correlated superconductor has been studied by means of the real space Bogoliubov-de Gennes equations approach. In this approach impurities have been treated exactly, as the corresponding equations have been solved on the small cluster. The role of randomness on the local properties of superconductors crucially depends whether the fermions are correlated or not. In the later case the positive correlation between the gap magnitude observed in scanning tunneling measurements has been shown to arise from local changes of bosonic levels with respect to chemical potential [1]. However, in the correlated case the gap has been shown to be larger near the impurity sites in system without bosonic disorder. The interplay between fermionic and bosonic disorder in the correlated case has been also discussed.

[1] J. Krzyszczak, T. Domański, K.I. Wysokiński, R. Micnas and S. Robaszkiewicz *Real space inhomogeneities in High Temperature Superconductors: the perspective of the Two-Component model* J. Phys.: Condens. Matter **22**, 255702 (2010).