EFFECTS OF RANDOMNESS ON SUPERCONDUCTIVITY AND CDW IN SYSTEMS WITH LOCAL ELECTRON PAIRING

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Abstract:

We analyse the properties of a model of coexisting itinerant electrons and local pairs (the hard-core boson-fermion model) in the presence od diagonal disorder. The phase diagrams and thermodynamic characteristics of this system are examined within MFA as a function of particle concentration (n) and the increasing disorder. Depending on the strength of random on-site potential, the interactions and n, the model is found to exhibit several various phases, including superconducting (SC), charge density wave (CDW) and the Bose-glass (NO), as well as the phase separated states (CDW-SC, CDW-NO and particle droplets). The obtained results for SC phase are in qualitative agreement with the available QMC simulations for two-dimensional lattice. In the presence of intersite density repulsion of local pairs the system can exhibit the phenomena which we call a disorder induced superconductivity and a disorder induced charge ordering. The relevance of our results to the interpretation of experimental data for the doped bimuthates and other materials with local pairs is pointed out. In particular, a disorder stabilized CDW may provide an explanation why the $Ba_{1-x}K_xBiO_3$ and $BaPb_{1-x}Bi_xO_3$ remain in the CDW state in a surprisingly large range of doping concentrations befor they become superconducting.

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