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Inhomogeneities in a strongly correlated d-wave superconductors in the limit of strong disorder DEBMALYA CHAKRABORTY, Indian Institute of Science Education and Research-Kolkata, Mohanpur Campus, India-741252, RAJDEEP SENSARMA, Department of Theoretical Physics, Tata Institute of Fundamental Research, Mumbai-400005, India, AMIT GHOSAL, Indian Institute of Science Education and Research-Kolkata, Mohanpur Campus, India-741252 — The complex interplay of the strong correlations and impurities in a high temperature superconductor is analyzed within a Hartree-Fock-Bogoliubov theory, augmented with Gutzwiller approximation for taking care of the strong electronic repulsion. The inclusion of such correlations is found to play a crucial role in reducing inhomogeneities in both qualitative and quantitative manner. This difference is comprehended by investigating the underlying one-particle "normal states" that includes the order parameters in the Hartree and Fock channels in the absence of superconductivity. This amounts to the renormalization of disorder both on the lattice sites and also on links. These two components of disorder turn out to be spatially anti-correlated through self-consistency. Interestingly, a simple pairing theory in terms of these normal states is found to describe the complex behaviors of dirty cuprates with reasonable accuracy. However, this framework needs modifications in the limit where disorder strengths are comparable to the band width. We will discuss appropriate updates in the formalism to describe physics of inhomogeneities with strong disorder.

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