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Pairing of renormalized eigenstates of disordered superconductors with strong correlations AMIT GHOSAL, DEBMALYA CHAKRABORTY, Indian Institute of Science Education and Research Kolkata, Mohanpur 741246, India, NITIN KAUSHAL, University of Tennessee, Knoxville, Tennessee 37996, USA
— Strongly correlated d-wave superconductors show amazing robustness to impurities up to moderate strengths within Hartree-Fock-Bogoliubov (HFB) calculations [1]. Motivated by this finding, we investigate the interplay of interactions and disorder in these systems using a simple pairing mechanism, similar to what leads to Anderson's theorem for s-wave superconductors. We first solve for the effective one-particle eigenstates in the presence of disorder, including the inherently strong electronic repulsions at the Hartree-Fock channels using Gutzwiller renormalization. These 'normal-states' are then paired up keeping track of disorder induced inhomogeneities. Our results, matching with those in the literature [1], show that the inhomogeneities in the normal-states is qualitatively different from the eigenstates of noninteracting disordered Hamiltonian. The pairing, however, reflects strong insensitivity to inhomogeneities. Our results shed light on why d-wave superconductivity is robust to disorder in HFB formalism, compared to conventional Abrikosov Gorkov mechanism.
(1) D. Chakraborty and A. Ghosal, New J. Phys. 16, 103018 (2014)

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