Mechanism For Superconducting Pairing In Strongly Correlated Layered Systems

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The interplay of charge fluctuations and spin fluctuations is investigated theoretically in the regime of strong fermionic correlations in a low dimensional conducting system. In the weak correlation regime described by the Fermi Liquid phenomenology, the charge and spin response functions can be related in a rather straightforward manner in terms of the Landau parameters. For the strongly correlated fermionic systems however, such connection is highly non-trivial, as the intra-site correlation energy plays the most dominant role. Nevertheless, the spin and charge response functions in this strong correlation regime can be expressed in terms of the corresponding stiffness constants and may be linked to each other. This approach is further extended to explore the posssibilty of emergence of attractive interaction between the charge degrees of freedom. This has tremendous consequences for the occurrence of intra-layer superconducting pairing instability as well as competition and cooperation with magnetic ordering and phase separation. Introducing a model for inter-layer pair transfer, the emergence of true superconductivity of 3-dimensional character is discussed. The theoretical results are discussed in the light of observations from various experimental systems.