World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:13, No:12, 2019

# Effective Charge Coupling in Low Dimensional Doped Quantum Antiferromagnets

**Authors :** Suraka Bhattacharjee, Ranjan Chaudhury

**Abstract :** The interaction between the charge degrees of freedom for itinerant antiferromagnets is investigated in terms of generalized charge stiffness constant corresponding to nearest neighbour t-J model and t1-t2-t3-J model. The low dimensional hole doped antiferromagnets are the well known systems that can be described by the t-J-like models. Accordingly, we have used these models to investigate the fermionic pairing possibilities and the coupling between the itinerant charge degrees of freedom. A detailed comparison between spin and charge couplings highlights that the charge and spin couplings show very similar behaviour in the over-doped region, whereas, they show completely different trends in the lower doping regimes. Moreover, a qualitative equivalence between generalized charge stiffness and effective Coulomb interaction is also established based on the comparisons with other theoretical and experimental results. Thus it is obvious that the enhanced possibility of fermionic pairing is inherent in the reduction of Coulomb repulsion with increase in doping concentration. However, the increased possibility can not give rise to pairing without the presence of any other pair producing mechanism outside the t-J model. Therefore, one can conclude that the t-J-like models themselves solely are not capable of producing conventional momentum-based superconducting pairing on their own.

**Keywords :** generalized charge stiffness constant, charge coupling, effective Coulomb interaction, t-J-like models, momentum-space pairing
**Conference Title :** ICCMMP 2019 : International Conference on Condensed Matter and Materials Physics
**Conference Location :** Bangkok, Thailand
**Conference Dates :** December 17-18, 2019