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Influence of multiorbital and anisotropic coulomb interactions on isotope effect coefficient in doped Fe-based superconductors

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The discovery of high -Tc superconductivity in cuprates by Bednorz and Müller and the recent finding of the high -Tc iron based superconductors by Kamihara group in 2008 changed the traditional concept and clearly indicated that BCS theory based on the electron-phonon interaction may not be able to explain such high Tc's and spin fluctuation since antiferromagnetic background can also contribute to the pairing mechanism, and still a debatable issue from the theoretical point of view. The isotope effect coefficients show a deviation (above and below the BCS limit) in Fe based high-Tc superconductors and need careful attention in any theoretical analysis. Motivated from the fact, the present work is devoted to a theoretical analysis of isotope effect coefficient as a function of transition temperature in two orbital per site model hamiltonian in Fe based superconducting system. The expression of isotope effect coefficient has been computed numerically and self-consistently by employing green's function technique within the BCS- mean-field approximation. It is observed that the isotope effect coefficient increases with the increase of the hybridization while with the increase in coulomb interaction it starts decreasing. On increasing the carrier density per site in two orbital per site iron pnictide system, isotope effect coefficient (α) exhibits large values (much higher than BCS limit) at lower temperatures, while in the under doped case, isotope effect coefficient shows minimum value in superconducting states of the iron based systems. Furthermore, it has been found that the large value of the isotope effect coefficient is the indication of the fact that the contribution of phonon alone is inadequate as the origin of superconductivity in these systems. Finally, the obtained theoretical results have been compared with experimental and existing theoretical observations in iron based superconductors.

Biography

Luxmi Rani has completed her PhD (Theoretical condensed matter physics: Superconductivity) from IIT Roorkee India in 2015 and received degree in 2016. She has worked as a Post-Doctoral Fellow in Theoretical Physics Division, Physical Research Laboratory Ahmedabad during 2015-2017. She has published over eight research papers in peer reviewed journals.

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