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Enhanced d-wave Superconducting Fluctuations in the 2D t-J model[1]

WILLIAM PUTIKKA, Ohio State University

I have calculated high temperature series to 12th order in inverse temperature for singlet superconducting correlation functions of the 2D t-J model with s-, $d_{x^2-y^2}$ and d_{xy}-symmetry pairs. The strengths of the different symmetry correlations are measured using $\mathbf{q} = 0$ correlation lengths. I find that for $J/t = 0.4$ the correlation length for $d_{x^2-y^2}$ pairing grows strongly with decreasing temperature, developing a broad peak around doping $\delta = 0.25$ when the temperature is reduced to $T/J = 0.25$. The correlation lengths for s and d_{xy} pairs remain small and do not display peaks as a function of doping. The temperature scale for growth in the $d_{x^2-y^2}$ correlation length agrees with the temperature scale where the temperature derivative of the momentum distribution function $dn_{\mathbf{k}}/dT$ and the gradient of the momentum distribution function $|\nabla_{\mathbf{k}} n_{\mathbf{k}}|$ develop peaks on the Brillouin zone diagonal. This indicates that the low energy excitations in the 2D t-J model are concentrated near the zone diagonal, as would be expected for superconducting order with $d_{x^2-y^2}$-symmetry pairs. I will also discuss differences between my calculation and previous calculations for superconducting correlations in the 2D t-J model.

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