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A COMPARISON BETWEEN THE SPIN FLUCTUATION SPECTRA OF UNDERDOPED AND OPTIMALLY DOPED $La_{2-x}Sr_xCuO_4$

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Time-of-flight neutron spectrometry has been used to study the spin excitation spectra of under doped (x = 0.10) and optimally doped (x = 0.163) $La_{2-x}Sr_xCuO_4$ (LSCO) over the full Brillouin zone at energies up to 40 meV, while retaining good resolution in both energy and wave vector. Each sample is studied in both normal and superconducting states. Our analysis allows us to obtain and compare "global views" of $\chi''(q, \omega)$, the imaginary part of the dynamic susceptibility, at the two doping levels. While the overall intensity distributions and absolute magnitudes of $\chi''(q, \omega)$ are similar, there are important differences in the spectral weight redistribution upon entering the superconducting state.

When compared with results on $YBa_2Cu_3O_{7-x}$, (YBCO) our data reveals striking similarities in $\chi''(q, \omega)$ for these two families of superconductors. These results challenge the commonly held view that the spin excitations of LSCO systems should be thought of in terms of stripe fluctuations[1-2] while those of YBCO can be most easily understood as arising from Fermi surface nesting.[3]

We discuss our results in the light of recent theories within the stripe[4] and Fermi surface nesting[5] schools of thought.

REFERENCES

1. J. M. Tranquada et al, Nature **375**, 561 (1995)
2. J. Zaanen and O. Gunnarsson, Phys. Rev. B **40**, 7391 (1989)
3. Q. Si et al, Phys. Rev. B **47**, 9055 (1993)
4. C. D. Batista, G. Ortiz and A. V. Balatsky, Phys. Rev. B **64**, 172508 (2001)
5. M. R. Norman, Phys. Rev. B **61**, 14751 (2000)