

Study of spin fluctuations in $\text{La}_{1.94-x}\text{Sr}_x\text{Ce}_{0.06}\text{CuO}_4$

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It is widely believed that spin correlations play an important role in the mechanism of high- T_c superconductivity[1]. Since, the static spin order competes with the superconductivity and such order is stabilized in the system with corrugated CuO_2 planes[2], a study of spin fluctuations in the system with flat CuO_2 plane, where the ideal superconducting state is considered to be realized, is more important. In order to shed light on this issue, we have carried out neutron-scattering experiments to investigate the effect of distortion of CuO_2 planes on the low-energy spin correlation of $\text{La}_{1.94-x}\text{Sr}_x\text{Ce}_{0.06}\text{CuO}_4$ with $x=0.14, 0.18$ and 0.24 , of which orthorhombic lattice distortion is smaller than that in $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ (LSCO) with comparable hole concentration.

As shown in Fig. 1, clear gap structure was observed in the energy spectrum of local dynamical susceptibility $\chi''(\omega)$ for both $x=0.18$ ($p\sim 0.14$) and $x=0.24$ ($p\sim 0.20$) samples, similar to the results for optimally-doped LSCO[3]. On the other hand, in the $x=0.14$ ($p\sim 0.10$) sample, a low energy component showing the increases of intensity below $2\sim 3\text{meV}$ with lowering ω was observed within the gap-like structure. Such a $\chi''(\omega)$ in $x=0.14$ is quite different from that for LSCO with $x'=0.10$, although the effective hole concentration in two samples is comparable[3]. These experimental results suggest that the gap-structure is robust against the lattice distortion, while the low-energy component is strongly influenced by the lattice distortion. We speculate that such reduction of the low-energy component is caused by the relaxation of corrugation of CuO_2 planes. In other words, the slowing down of spin fluctuations oc-

curs in the system with corrugated CuO_2 planes. Moreover, the appearance of gap-like structure in $\chi''(\omega)$ by reducing the lattice distortion would be the evidence for the existence of spin-gap states in the underdoped La214 system. Further systematic neutron-scattering experiments are required to clarify the intrinsic spin correlations in the high- T_c superconductors.

References

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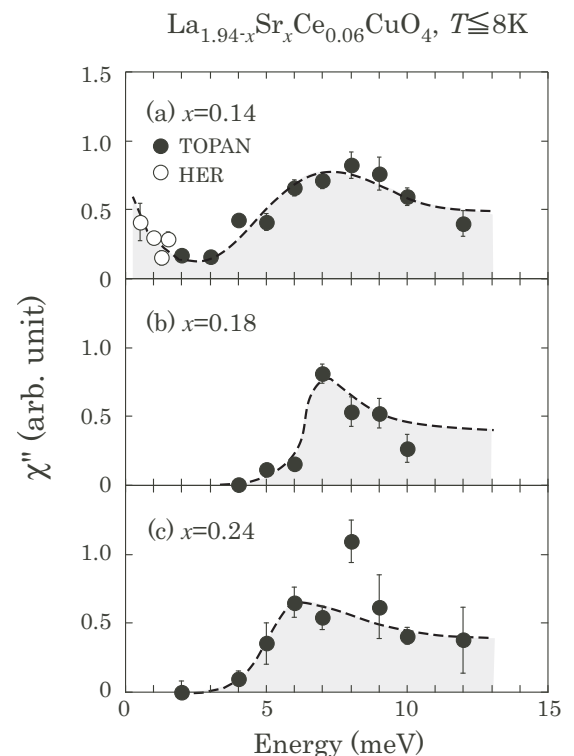


Fig. 1. Local spin susceptibility for $\text{La}_{1.94-x}\text{Sr}_x\text{Ce}_{0.06}\text{CuO}_4$ with (a) $x=0.14$, (b) 0.18 and (c) 0.24 measured below 8K .