

Spin fluctuations of single-layer in $\text{Bi}_{2+x}\text{Sr}_{2-x}\text{CuO}_{6+\delta}$ superconductor

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Inelastic neutron-scattering measurement is a powerful technique for the study of spin dynamics and lattice vibrations (phonon) in condensed matters such as high- T_c superconductors. Systematic neutron-scattering experiments on the high- T_c superconducting systems of $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ (LSCO) and $\text{YBa}_2\text{Cu}_3\text{O}_{6+\delta}$ (YBCO) revealed an existence of similar dispersion in the spin excitation spectrum [1, 2]. Therefore, the spin correlation is considered to closely connect with the superconductivity. On the other hand, an interaction of the phonon and the electron seems to be also important in the high- T_c superconductor because anomalous softening in the bond-stretching phonons were observed in the superconducting phase of both LSCO and YBCO systems. Thus, the origin of pairing force for the emergence of high- T_c superconductivity, namely spin fluctuations, phonon and others, is still discussed. However, since the high- T_c superconducting systems studied by neutron-scattering experiments are quite limited, other reference systems are highly required for the clarification of universal nature in spin excitations and phonons. Motivated by the above reason, we have started the study on $\text{Bi}_{2+x}\text{Sr}_{2-x}\text{CuO}_{6+\delta}$ (Bi2201) system.

The crystal growth of Bi2201 superconductor is known to be much difficult than that of LSCO and there is no report on the spin dynamic and phonon investigated by neutron-scattering measurement. We have, however, found adequate growth condition of sizable single crystal, and succeeded in observing inelastic magnetic signals in Bi2201 system for the first time.

Figure 1. shows the low-energy spin fluctua-

tions below 11 meV in the $x=0.2$ sample (hole concentration is ~ 0.17). Interestingly, the magnetic signals were observed at $(0.5 \pm \delta, 0.5)/(0.5, 0.5 \pm \delta)$ with $\delta \sim 0.12$ (r.l.u.) in the tetragonal notation, which is consistent with those reported for LSCO system with comparable carrier concentration [3]. This observation of incommensurate structure in the single-layer Bi2201 provides provides important opportunity to explore the generic feature of spin excitation spectra in high- T_c cuprates.

References

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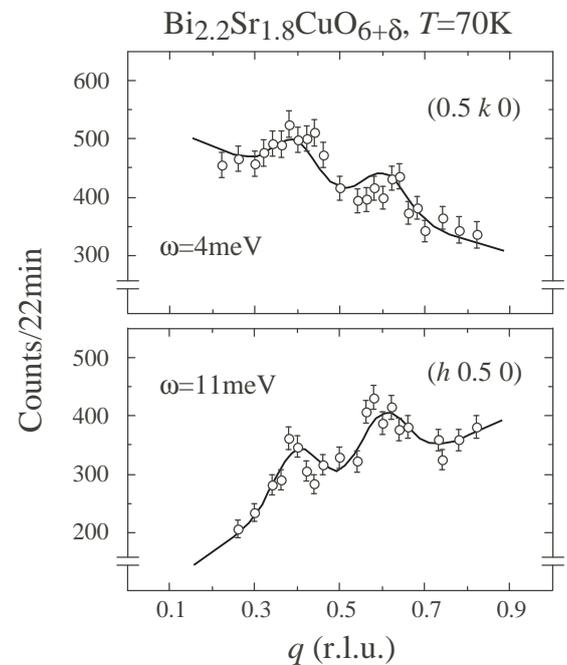


Fig. 1. Inelastic neutron scattering spectra of $\text{Bi}_{2.2}\text{Sr}_{1.8}\text{CuO}_{6+\delta}$ with constant energy of 4 meV and 11 meV measured at 70K.