表題：高温超伝導体 Bi2212 における磁気励起ピークの探索

Investigation of the magnetic excitations in high-T_C cuprates $Bi_{2.1}Sr_{1.9}CaCu_2O_{8+\delta}$

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The interplay between antiferromagnetic (AF) spin fluctuations and superconductivity is the central issue in the physics of high-transition temperature (high-T_c) superconductivity because of the persistent AF fluctuations in the superconducting phase. Recently, similar magnetic spectra have been reported from two families of high-Tc materials, $La_{2-x}Ba_xCuO_4$ and $YBa_2Cu_3O_{6+x}$[1, 2], which includes a characteristic hourglass magnetic excitation. If spin fluctuations are important for the mechanism of high-T_c superconductivity, they should be universal for all copper-oxide systems. Although two families of high-T_c materials show the similar magnetic excitation spectrum, it is still not clear whether they are the universal feature of all cuprates. One way to resolve this issue is to investigate another high-T_c system $Bi_{2.1}Sr_{1.9}CaCu_2O_{8+\delta}$ (Bi2212). We explored the magnetic spectrum in optimally doped Bi2212. Single crystals of Bi2212 were grown using travelling-solvent-floatingzone method. Neutron scattering experiments were performed on the triple-axis spectrometer PONTA installed at the JRR-3 Reactor of the JAEA. We have aligned 19 single crystals on Al plates. The total mass of aligned crystals is 16.5g (2.5cc), which is 40 times as large as the crystal used in the previous report[3].

Our experiment shows a clear enhancement of the scattering at (π,π) around 36 meV below T_c, however, we could not confirm the Q dependence expected from a magnetic peak. Figure 1(a) shows the difference spectrum at $T = 1.2$ K ($T < T_c$) and 100 K ($T > T_c$) at Q =(1/2 1/2 -14) as a function of energy. Although the difference spectrum have a peak around 36 meV, the peak at (π,π) in the Q-scan (shown by closed circles in Fig.1(b)) disappears at (3π,3π) (open circles). If the peak at $E = 36$ meV and (π,π) is magnetic in origin, the peak intensity should follow the square of magnetic form factor of Cu^{2+} which decreases from 0.43 at (π,π) to 0.19 at (3π,3π). Further investigation of the magnetic excitations in Bi2212 will be required by using polarized neutrons.

References

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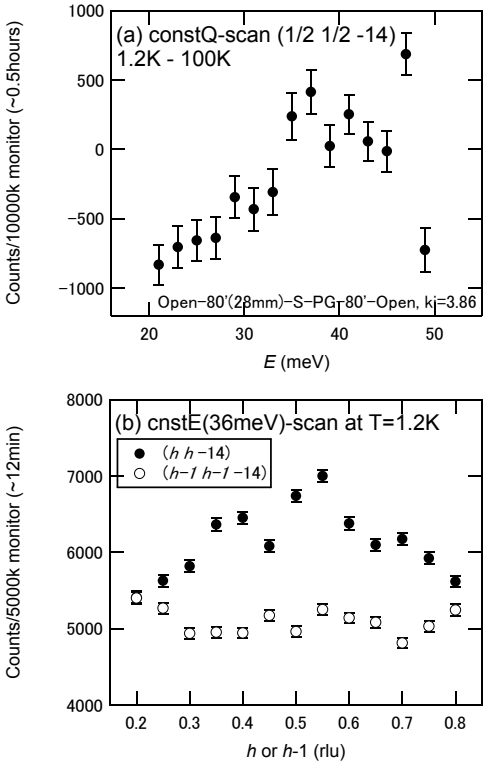

Fig. 1. a) Difference spectrum of constant-Q scan at (1/2 1/2 -14) at $T = 1.2$ K ($T < T_c$) and 100 K ($T > T_c$). b) constant-Energy spectra at $\hbar\omega = 36$ meV with (hh-14) and ($h-1$ $h-1$ -14).

使用施設：JRR-3M，装置：5G:PONTA
分野：Strongly Correlated Electron Systems