Magnetic Excitation in YBaCo4O7 having kagome and triangular lattices

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Spin systems on the pyrochlore, triangular and kagome lattices are well-known examples of geometrically frustrated systems and expected to exhibit various interesting properties induced by strong magnetic fluctuations. $RBaCo_4O_7$ (R=Ca, Y and rare-earth elements) is one of typical examples of such systems, because it has both triangular and kagome lattices formed by CoO_4 tetrahedra. In our previous study of $YBaCo_4O_7$,[1] the magnetic transitions were found at two temperatures 70 and 105 K. With decreasing T, the short range magnetic order of Co sites was found to appear along with the transition at 105K. These reflections did not grow up to an ideal long-range order even at the lowest T studied (~10 K). With further decreasing T, the growth rates of the intensities of these two groups were found to be enhanced by the transition at 70 K.

The magnetic correlations of $YBaCo_4O_7$ having the triangular and kagome lattices are the short-range ordering, and their orderings are expected to connect with the spin chirality. The charity ordering may correspond with the Z_2 vortex (topological) transition which is characterized by its parity [2]. Since the degree of freedom of the chirality which survives below the transition temperature enough to destroy the spin ordering, the spin correlation length with the Z_2 vortex remains finite at any finite temperature ($T > 0$). In order to clarify the magnetic dynamics and the possibility of Z_2 vortex transition in the novel chirality ordering $YBaCo_4O_7$ having the triangular and kagome lattices, we have carried out the inelastic neutron scattering on $YBaCo_4O_7$ single crystal using the chopper spectrometer CNCS. If the Z_2 vortex transition occurs, the novel central peak will appear even at wavevectors away from the K point. Furthermore, the intensity of the central peak has the maximum at Z_2-vortex the transition temperature.

At T=110 K, the characteristic central peak which is the hexagon shape in the c-plane has been observed. This central peak disappears at low temperature (T~ 10 K) and high temperature (T~300 K), and this has the maximum intensity around the transition temperature (T~105 K). These results consistent with the theoretical suggestion of Z_2-vortex[2].

Although the central peak disappears at low temperature as stated above, magnetic mode with finite and discrete energy (E~5 meV) is observed. This behaviour is similar to the result of the geometrical frustration system.[3,4]. At this moment, we try to make the analyses of the inelastic neutron results in consideration of both the Z_2-vortex transition and the geometrical frustration system.

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[3] S.-H. Lee *et al.* PRL **84** (2000) 3718.

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