Neutron Scattering Study in Breathing Pyrochlore Antiferromagnet $Ba_3Yb_2Zn_5O_{11}$

T Masuda [1], T Haku [1], M Soda [1], M Sera [2], K Kimura [2], J Taylor [3], S Itoh [4], T Yokoo [4], Y Matsumoto [5], D Yu [6], R. A. Mole [6], T Takeuchi [2], S Nakatsuji [1], Y Kohno [1], T Sakakibara [1], and L.-J Chang [7]

[1]*University of Tokyo, Japan*

[2]*Osaka University, Japan*

[3]*ISIS, U.K.*

[4]*KEK, Japan*

[5]*Max Planck Institute, Germany*

[6]*ANSTO, Australia*

[7]*NCKU, Taiwan*

Comprehensive study on breathing pyrochlore antiferromagnet Ba3Yb2Zn5O11 [1] is presented. To identify the energy scheme of crystalline electric field (CEF), we performed inelastic neutron scattering (INS) measurement in high energy range. The observed dispersionless excitations are explained by a CEF Hamiltonian of Kramers ion Yb3+ of which the local symmetry exhibits *C*3*v* point group symmetry. The magnetic susceptibility is consistently reproduced by the energy scheme of the CEF excitations. To identify the spin Hamiltonian we performed INS experiment in low energy range and thermodynamic property measurements at low temperatures. The INS spectra are quantitatively explained by spin-1/2 single-tetrahedron model having *XXZ* anisotropy and Dzyaloshinskii-Moriya interaction. This model has a two-fold degeneracy of the lowest-energy state per tetrahedron and well reproduces the magnetization curveat 0.5 K and heat capacity above 1.5 K. At lower temperatures, however, we observe a broad maximum in the heat capacity around 63 mK, demonstrating that a unique quantum ground state is selected due to extra perturbations with energy scale smaller than the instrumental resolution of INS. Possible mechanisms for the ground state selection are discussed [2]. [1] K. Kimura *et al*., PRB **90**, 060414(R) (2014). [2] T. Haku etal., PRB **93**, 220407(R)(2016).