

Evaluation of the exchange couplings in the Spin-Polyhedron system by ESR

Y. Oshima, H. Nojiri, P. Kögerler^A, M. Luban^A, J. Schnack^B

IMR Tohoku Univ., Ames Lab ISU^A, Bielefeld Univ.^B

Recently, a huge progress has been made on the chemical synthesis of the frustrated spin-cluster systems which have a huge number of states. The most notable compound is the $\text{Mo}_7\text{2M}_3\text{O}$ ($\text{M}=\text{V}, \text{Cr}, \text{Fe}$), where 30 magnetic ions form an icosidodecadron (a polyhedron with a triangular and pentagonal network) structure, and we have studied systematically its magnetic properties under the high magnetic field [1,2]. The $\text{Mo}_7\text{2V}_3\text{O}$ and its related substance $\text{Mo}_7\text{5V}_2\text{O}$, which consists of V^{4+} ions with $S = 1/2$, are the quantum version of these polyhedron systems, and a lot of attention is paid in its ground states and its magnetic properties in the high magnetic field. Although the exchange interactions of both systems are expected to be strong,

The evaluation of the exchange couplings is difficult in both systems due to the Van-Vleck paramagnetism and the contamination of the magnetic impurities inside the compound. Hence, we have performed ESR measurements, which can separate the intrinsic signal and the signal from the impurities, and have succeeded to observe the ESR coming from the excited states. From our careful analysis of the ESR intensities and theoretical calculations, we will present our estimation of the gap and the electronic state between the singlet and triplet states, and our evaluation of the exchange coupling constants between the spins, of these Spin-Polyhedron systems.

[1] C. Schröder *et al.* Phys. Rev. Lett. **94**, 017205 (2005).

[2] Y. Oshima *et al.* JPS Annual Meeting 2006, 27aTE-8.