On the Anti-decoupling Phenomena in LF-μSR

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We have reported a μSR study of random frustrated antiferromagnet $LuFeMgO_4$ in the longitudinal fields, in which the relaxation of the muon is noticeably faster than the zero field case in a particular temperature region slightly above the magnetic transition [1]. Since the behavior is not always familiar in the μSR study of magnetic materials, it is of some importance to reveal the origin of the phenomenon. The substance consists of pairs of highly diluted triangular lattices and there are several unique situations: a sharp cusp in the uniform magnetic susceptibility together with the cooling field dependence and the persisting short range spin correlation above the cusp-temperature due to the geometrical frustration. In order to obtain more complete insight, computational studies of the spin dynamics and the dipole-field dynamics have been carried out. Especially, attention has been paid to the role of the antiferromagetic inhomogeneity which enhances the response to the uniform external fields. This antiferromagetic inhomogeneity is considered to be an important property of real antiferromagnetic substances with "spatially correlated irregularity" [2]. Static and dynamical properties of the local dipole field are compared for models of $LuFeMgO_4$ with various antiferromagetic inhomogeneity. It will be shown that spin and local dipole-field dynamics are significantly affected by the external field in a lattice with the enhanced susceptibility. This effect is visible in a wider temperature range in the lattice with the enhanced susceptibility (Fig. 1). Muon spin relaxation in these characteristic local dipole-fields will be discussed.

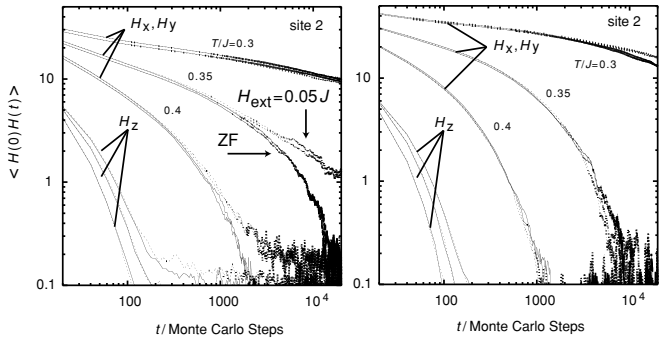

Fig. 1: Effect of the external field on the fluctuating dipole fields for two models of $LuFeMgO_4$.

[1] Y. Todate et al., Hyperfine Int. **104** (1997) 375.
[2] Y. Todate, J. Phys. Soc. Jpn., **73** (2004) 198.