別紙様式８(Attached Form 8)

研　究　主　論　文　抄　録 Abstract of Thesis

論文題目 Title of Thesis　：

Low Temperature NMR Study on Spontaneous Magnetization of Nearly Two Dimensional Spin Systems

（二次元スピン系の自発磁化に関する極低温での NMR 研究）

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専攻 Field　Physics　　講座 Course：Doctoral
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主論文要旨 Summary of Thesis
《本文》《Body text》

Two dimensional Heisenberg magnets could not exhibit a spontaneous magnetization at any non-zero temperatures, if the interactions are limited within a finite range. A finite Curie temperature in the two dimensional ferromagnetic system is due to small deviation from Heisenberg system or due to small inter-plane exchange interaction or dipolar interaction.

The purpose of this paper is investigation of magnetically ordered state of nearly two dimensional spin systems. I have obtained some important information by nuclear magnetic resonance (NMR) study on K_2CuF_4, $(C_3H_7NH_3)_2CuCl_4$ and Mn Formate di-Urea at low temperatures. Those spin systems are of typical two dimensional magnets.

The thesis contains the following two main results.

Spontaneous magnetization of Nearly Two Dimensional Heisenberg Ferromagnet

In this experimental study, the temperature dependence of spontaneous magnetization is investigated using NMR without external field. NMR frequencies of ^{63}Cu nuclei are measured in a single crystal of K_2CuF_4, ^{65}Cu and ^{35}Cl nuclei are measured in a single crystal of $(C_3H_7NH_3)_2CuCl_4$. Measurements of spontaneous magnetization are taken at temperature range of 2K down to 30mK using ^{3}He-^{4}He

dilution refrigerator.

Yamaji and Kondo [1975] have developed a theory based on the double time Green function method incorporating the Tyablikov's decoupling.

The results of my experimental measurements on K_2CuF_4 are in good agreement with Yamaji-Kondo theory if it is assumed that a parameter of θ_c of the theory equals 0.30±0.01. The magnetization of $(C_3H_7NH_3)_2CuCl_4$ is proportional to t log t' which is derived by the spin wave theory, where t and t' are the reduced temperatures.

Spin Lattice Relaxation of Mn Formate di-Urea

Proton spin lattice relaxation of $Mn(HCOO)_2 \cdot 2(NH_2)_2CO$ single crystal below Néel temperature (T_N = 3.78K) is investigated with conventional pulsed NMR apparatus in external magnetic fields below 1.5T. The NMR frequencies are observed from about 8MHz to 20MHz in the temperature range of 1.2K to 4.2K. $Mn(HCOO)_2 \cdot 2(NH_2)_2CO$ is composed from $Mn(HCOO)_2 \cdot 2H_2O$ by replacing the water molecules by $2(NH_2)_2CO$.

The results of the spin lattice relaxation time show clearly that the spin system is composed of two components, named A and B. A is the usual antiferromagnetic ordered state and B is the paramagnetic state.