Session 25bC

^{55}Mn NMR in Mn_{12} acetate: Quantum tunneling and magnetic relaxation of Mn_{12} cluster **25bC1**

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For studying the relaxation of Mn_{12} cluster (S=10) associated with quantum tunneling, we have investigated ^{55}Mn NMR on Mn_{12} acetate in the external fields. With increasing longitudinal fields, the relaxation time decreased following significant dips at every 0.45 T, which is due to the effects of phonon-assisted quantum tunneling between the spin states at magnetic level crossings. The relaxation has been also shown to depend on the reversing-rate of the fields.

Magnetic Properties of V15 Molecular Magnet **25bC2**

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We apply the ESR and magnetization techniques to reveal the magnetic properties of a facinating molecular magnet, $K_6[V_{15}As_6O_{42}(H_2O)]\cdot 8H_2O$ (so-called V15). The results are discussed in terms of quasi-noninteresting sub-units of a weakely antiferromagnetically coupled triangle sandwiched with two strongly AF coupled hexagons. A profound "layer structure" has paramount importance in determining the unusual magnetic properties of this molecular magnet.

25bC3 Coherent spin quantum dynamics in antiferromagnetic molecular rings

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Molecular magnetic clusters with antiferromagnetic exchange interaction and easy axis anisotropy belong to the most promising candidate systems for the observation of coherent spin quantum tunneling on the mesoscopic scale. Various antiferromagnetic molecular rings of this type have been synthesized to date, the most prominent examples being the ferric wheels. The experimental detection of coherent spin quantum tunneling in antiferromagnetic molecular clusters requires probes which allow one to trace the dynamics of single spins within the cluster. We point out that both nuclear magnetic resonance and electron spin resonance on doped rings are adequate experimental techniques. Although challenging, the detection of coherent spin quantum tunneling in antiferromagnetic molecular rings is feasible with present day techniques. [Phys. Rev. Lett. **86**, 5373 (2001); Phys. Rev. B **64**, 224411 (2001).]

25bC4 Real time scale simulation for quantum processes in dissipative environments

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Nanoscale magnets show dynamics of magnetization responding time dependent external fields. If the field changes faster than the time scale of the system, the system can not follow the change of the field and it shows so-called non-adiabatic process. On the other hand, if the change of the field is slow, the system follows the change adiabatically. However, if the change is too slow, the environment cause the thermaization and the system shows additional characteristics, e.g. the phonon-bottleneck process in V_{15} and magnetization process of Fe-rings, such as Fe_{12}, etc. In order to study such cases numerically, we have to simulate very long time comparing with the precession period of the magnetization. We will present a new method to study dissipative processes for long time. With this method we will clarify characteristics of dynamics of nanoscale molecular magnets.

25bC5 Quantum Tunneling of Magnetization in Molecular Nanomagnet Fe_8 Studied by NMR

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Magnetization and NMR measurements have been performed for single crystals of molecular magnet Fe_8. The temperature and field dependences of magnetization below 25 K are well described in terms of the isolated clusters with the total spin $S = 10$ composed of eight iron ions with spin $s = \frac{5}{2}$. The proton spin relaxation rates $1/T_1$ were measured down to 20 mK. The results above 400 mK show that the magnetic fluctuation is caused by the thermal transition of the electron states between the discrete energy levels separated by the single-ion-type anisotropy. Below 400 mK, the relaxation rates are temperature independent. In this temperature region the stepwise recoveries of NMR signals at the level crossing fields caused by the resonant quantum tunneling of magnetization were observed.

NMR studies on spin dynamics of the molecular nanomagnet Mn12 **25bC6**

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Inner spin structure and spin dynamics of the Mn12 cluster in its high spin S=10 ground state has been studied by ^{55}Mn nuclear magnetic resonance (NMR) under both external magnetic fields parallel and perpendicular to the magnetic easy-axis. The external field dependence of ^{55}Mn-NMR spectrum gives a direct confirmation of the internal spin structure of the Mn12 cluster, in which spin moments of Mn^{4+} (S=3/2) ions are polarized antiparallel to that of Mn^{3+} (S=2) ions. It is proved that the microscopic spin configuration rotates rigidly when the external magnetic field is applied perpendicular to the easy-axis.