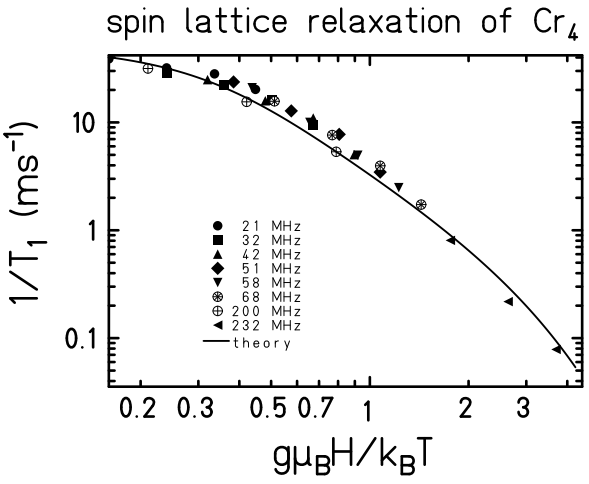
Dynamics of Small Magnetic Systems

K. Bärwinkel, D. Mentrup, H.-J. Schmidt, J. Schnack

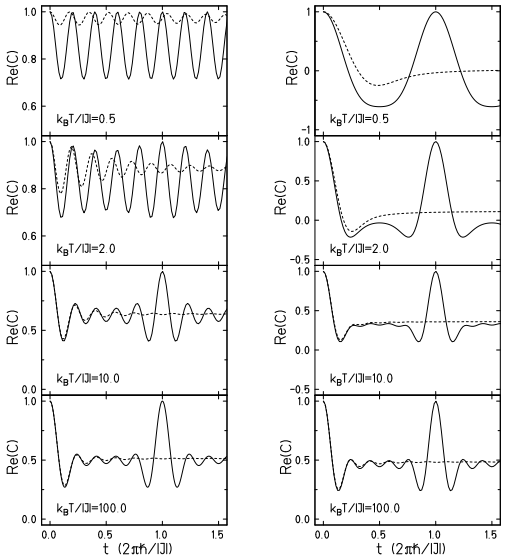
University of Osnabrück, Germany

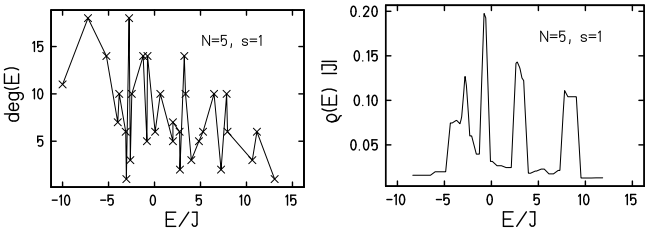


A new class of nanometer-size magnetic materials could be synthesised during past years. The molecules host from two up to thirty interacting paramagnetic ions. A large number of nonmagnetic organic ligands surrounds the paramagnetic ions, therefore intermolecular interactions are weak and measurements on a bulk sample reflect intramolecular interactions only.

Molecular magnets promise a variety of applications ranging from mesoscopic magnets in biological systems, computer displays, photonic switches to catalysts.

To characterize molecular magnets and their thermodynamic properties measurements of susceptibility, spin lattice relaxation time and neutron scattering cross section are performed. The latter two are connected to the spin-spin-correlation function which we calculated for several systems. It turns out that the spin lattice relaxation time T_1 of Cr_4 is well understood over three orders of magnitude (graphics above). In another investigation we compared classical (dashed) and quantal solutions (solid) for the spin dimer to check under which conditions the much simpler classical treatment may be applied (right graphics).





Before going to larger molecules we calculated exactly the relevant dimensions occurring in Heisenberg spin rings utilizing the possible symmetries as global rotations, rotations about the z-axis and cyclic shifts.

For small systems analytical eigenvalues of the hamiltonian could be derived, which are shown together with the density of states.

A part of this work was done in collaboration with Marshall Luban, Ames Laboratory, Iowa. Publications can be found at
http://www.physik.uni-osnabrueck.de/makrosysteme/