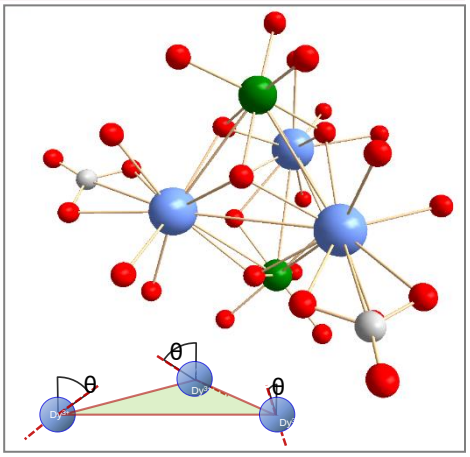
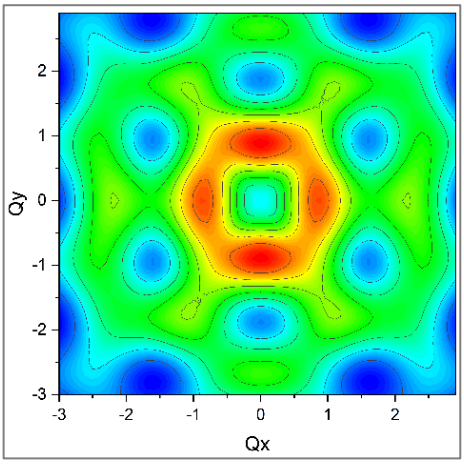
Master Thesis Project

Is it possible to prove Toroidal Magnetic Moments in Single Molecule Magnets by Neutron Spectroscopy?



Molecular nanomagnets provide an ideal opportunity to study quantum mechanics in small, finite systems, and a large variety of non-trivial quantum effects can be observed. Neutron scattering is an outstanding, unrivaled experimental technique to investigate magnetism with spectroscopic detail, which helps us to identify and understand quantum effects especially in the molecular nanomagnets.

Under certain conditions, molecular nanomagnets can exhibit a striking, unconventional magnetic state, which is characterized by the presence of a so-called toroidal magnetic moment, an analogue of Skyrmions in SMMs. These novel quantum states are predicted to have huge potential in quantum information technology, e.g., as so-called qudits (multi-level versions of the familiar qubits). The experimental evidence for the existence of these toroidal states in the molecular nanomagnets is however only indirect or through thermodynamic observables such as magnetization. Direct spectroscopic observation has not yet been conducted. The direct confirmation of toroidal magnetic moments would be a spectacular experimental achievement.



The aim of this thesis is to identify, by means of numerical simulations and theoretical understanding, an experimental protocol for the observation of toroidal magnetic moments in neutron scattering studies. Possible neutron scattering techniques include inelastic neutron scattering and spin-polarized neutron scattering.

What do you learn?

- Quantum Magnetism
- C - based Coding & Numerics
- Advanced Experimental Technique

Interested?

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