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Magnetoelastic coupling as a relaxation pathway for single ion magnets observed using inelastic neutron scattering.

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Single ion magnets (SIM's), are materials that show an energy barrier to spin reorientation without long range magnetic order. Such materials have been postulated to be useful as potential materials for high density data storage or to be used as Qubits. The origin of the effect lies in the crystal field splitting of the central lanthanoid ion. The determination of crystal field splitting has long been performed using INS and this has been readily extended to SIM's [1]. In recent years the operating temperature of these SIM's has increased dramatically with magnetic hysteresis observed above liquid nitrogen temperatures [2]. The limiting factor is no longer the height of the energy barrier for reorientation, but minimization of relaxation by varying methods such as quantum tunneling of magnetization and Orbach relaxation. Such phenomena have previously been shown to be measurable using INS and QENS techniques [3,4,5]. In our recent work we have revisited the INS of Na9[Ho(W5O18)2] to analyse both the presence or absence of a QENS signal to determine whether Orbach relaxation occurs [3]. We have also performed an analysis of the peak widths of the crystal field excitations and modelled these using a magnetoelastic model [4]. This reanalysis demonstrates that INS holds more information than just the energy scale of the system for single ion magnets.

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[3] M. Roepke, et al, Physical Review B, 60, 9793 (1999)
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[5] M. Ruminy, et. al, Physical Review B 95, 060414(R) (2017)

Level of Expertise

Experienced Researcher

Presenter Gender

Man

Pronouns

He/Him

Which facility did you use for your research

Australian Centre for Neutron Scattering

Students Only - Are you interested in AINSE student funding

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Condition of submission

Yes

Primary author(s) : MOLE, Richard (ANSTO); DUNSTAN, Maja (University of Melbourne); Dr CALVELLO, Simone (The University of Melbourne); YU, Dehong (Australian Nuclear Science and Technology Organisation); Prof. SONCINI, Alessandro (University of Melbourne); BOSKOVIC, Colette (University of Melbourne)

Presenter(s) : MOLE, Richard (ANSTO)

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