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Low temperature spin dynamics and high pressure effects in frustrated pyrochlores

ISABELLE MIREBEAU, Laboratoire Léon Brillouin CEA/CNRS, CE-Saclay, 91191 Gif sur Yvette France

Frustrated pyrochlores $R_2M_2O_7$, where R^{3+} is a rare earth and M^{4+} a transition or sp metal ion, show a large variety of exotic magnetic states due to the geometrical frustration of the pyrochlore lattice, consisting of corner sharing tetrahedra for both R and M ions. Neutron scattering allows one to measure their magnetic ground state as well as the spin fluctuations, in a microscopic way. An applied pressure may change the subtle energy balance between magnetic interactions, inducing new magnetic states. In this talk, I will review recent neutron results on Terbium pyrochlores, investigated by high pressure neutron diffraction and inelastic neutron scattering. $Tb_2M_2O_7$ pyrochlores show respectively a spin liquid state for M=Ti [1], an ordered spin ice state for M= Sn [2], and a spin glass state with chemical order for M=Mo [3]. In $Tb_2Ti_2O_7$ spin liquid, where only Tb^{3+} ions are magnetic, an applied pressure induces long range antiferromagnetic order due to a small distortion of the lattice and magneto elastic coupling [4]. In $Tb_2Sn_2O_7$, the substitution of Ti^{4+} by the bigger Sn^{4+} ion expands the lattice, inducing a long range ordered *ferromagnetic* state, with the local structure of a spin ice [2] and unconventional spin fluctuations [2,5]. The local ground state and excited crystal field states of the Tb^{3+} ion were recently investigated by inelastic neutron scattering in both compounds [6]. $Tb_2Mo_2O_7$, where Mo^{4+} ions are also magnetic, shows an even more rich behaviour, due to the complex interaction between frustrated Tb and Mo lattices, having respectively localized and itinerant magnetism. In $Tb_2Mo_2O_7$ spin glass, the lattice expansion induced by Tb/La substitution yields an ordered ferromagnetic state, which transforms back to spin glass under applied pressure [7]. New data about the spin fluctuations in these compounds, as measured by inelastic neutron scattering, will be presented. The talk will be dedicated to the memory of Igor Goncharenko, a renowned high pressure and neutron physicist, who died accidentally on Nov. 4^{th}, 2007.

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