CEA - Saclay 91191 Gif-sur-yvette Cedex

Service de Physique de l'Etat Condensé

SÉMINAIRE

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Jeudi 5 juin 11h00

Orme des Merisiers SPEC Salle Itzykson, Bât.774

How Frustrating: a look at recent neutron data in the frustrated pyrochlores $Tb_2Ti_2O_7$ and $Tb_2Sn_2O_7$

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I would like to talk about geometrically frustrated materials, specifically, the cubic pyrochlores $Tb_2Ti_2O_7$ and $Tb_2Sn_2O_7$. In these materials the magnetic Tb^{3+} ions form a network of corner sharing tetrahedra. Combined with antiferromagnetic interactions, these materials cannot simultaneously minimise the interaction energy between each nearest neighbour magnetic ion thus leading to a highly degenerate, frustrated system. $Tb_2Ti_2O_7$ has been observed to remain dynamically frustrated down to temperatures as low as 70 mK1 while $Tb_2Sn_2O_7$ enters an ordered state with ferromagnetic correlations below 1 K2. Time of flight neutron scattering was performed on a single crystal of $Tb_2Ti_2O_7$ and a polycrystalline sample of $Tb_2Sn_2O_7$at the NIST Center for Neutron Research, USA. Magnetic fields of up to 8.5 T, were applied to the $Tb_2Ti_2O_7$ crystal along the $\langle 110 \rangle$ direction to induce long range magnetic order at T = 1 K. This applied field clearly splits the degenerate excited state doublet, and induces a dispersive collective spin excitation which appears to go to zero energy at the 001 and, possibly, 003 zone centres. These results require continuous spin degrees of freedom to be relevant to the Tb^{3+} moments. Recent triple axis and polarized neutron scattering measurement have shown that below 0.8 K $Tb_2Sn_2O_7$ has a similar energy landscape to that in $Tb_2Ti_2O_7$, revealing the importance of antiferromagnetic correlations in these materials.

Refs.:

1. Gardner et al., Phys. Rev. Lett. 82,1012 (1999)
2. Mirebeau et al., Phys. Rev. Lett. 94, 246402 (2005)

ATTENTION : JOUR INHABITUEL