Comparison of the Magnetic and Crystal Field Excitations in Orthorhombically Distorted Vanadates and Multiferroic Manganites

N. Reynolds[a], P. Rovillain[a,b], N. Narayanan[b,c], F. Fujioka[d], Y. Tokura[d], S. Danilkin[b], A. M. Mulders[c], G. McIntyre[b], and C. Ulrich[a,b],

[a] School of Physics, University of New South Wales, Sydney NSW 2052, Australia
[b] Bragg Institute, ANSTO, Lucas Heights, NSW 2234, Australia
c School of Physical, Environmental and Mathematical Sciences
Canberra Campus, The University of New South Wales, Canberra ACT 2600
[d] Multiferroics Project, ERATO, Japan Science and Technology Agency,
[e] Department of Applied Physics, University of Tokyo, Tokyo 113-8656, Japan

Magnetism and ferroelectricity are both exciting physical properties and are used in everyday life in sensors and data storage. In multiferroic materials both properties coexist. They offer a great potential for future technological applications like the increase of data storage capacity or in novel senor applications.

We have performed a comparative inelastic neutron scattering (INS) investigation on a series of vanadates, in particularly $TbVO_3$, $DyVO_3$, $PrVO_3$, and $CeVO_3$, with their multiferroic Mn-counterparts. The Vanadates are isostructural to the multiferroic materials $TbMnO_3$ and $DyMnO_3$, but posses a collinear antiferromagnetic spin arrangement below $T_N \approx 110$ K [1-3] instead of a cycloidal spin structure below $T_{FE} \approx 28$ K [4]. By using inelastic neutron scattering we have obtained the spin wave dispersion relation and the crystal field excitations of the V-sublattice and the rare earth ions, respectively. The data will be compared with previously obtained INS data of D. Senff on $TbMnO_3$ [5] and our INS data on $DyMnO_3$ with the intention of uncovering information about the complex interplay between the magnetic moments of the rare earth ions its role in the formation of the multiferroic phase.

[1] J. Fujioka, S. Miyasaka, and Y. Tokura, Phys. Rev. B 72, 024460 (2005)
[2] M. Reehuis, et al., Eur. Phys. J. B 64, 27–34 (2008)
[3] M. Reehuis, et al., Phys. Rev. B 83, 064404 (2011)
[4] M. Kenzelmann, et al., Phys. Rev. Lett. 95, 087206 (2005)
[5] D. Senff, et al., Phys. Rev. B 77, 1 (2008)