INTERNATIONAL CONFERENCE ON MAGNETISM

KARLSRUHE ICM 09

ICM 2009

July 26 - 31 2009 Karlsruhe Germany

Courtesy of Bildstelle Stadt Karlsruhe, D-76124 Karlsruhe

PROGRAM AND ABSTRACTS

Congress Center Stadthalle Karlsruhe

Th-D-3.2-05

Hybrid Goldstone modes in hexagonal multiferroic $YMnO_3$

Xavier Fabrèges[1], Sylvain Petit[1], Stéphane Pailhès[1], Isabelle Mirebeau[1], Loreynne Pinsard[2], Louis-Pierre Régnault[3]
[1] *LLB, CEA-CNRS UMR 12, CE-Saclay, F-91191 Gif-sur-Yvette, France*
[2] *ICMMO, UMR CNRS 8182. Bât 410, Université Paris Sud, F-91405 Orsay Cedex, France*
[3] *CEA-Grenoble, DRFMC-SPSMS-MDN, 17 rue des Martyrs, F-38054 Grenoble Cedex 9, France*

Multiferroics arouse much attention, due to their intriguing properties, showing co-existing and strongly coupled ferroelectric and magnetic orders. At the moment, the microscopic mechanism at the origin of this coupling remains unknown. To shed light on this problem, recent studies have been devoted to identify the low energy excitations associated with the multiferroic phase. We focus on the particular case of YMnO3 and report polarized inelastic neutron scattering experiments proving the existence of such hybrid modes[1]. In addition, as neutron scattering allow a global survey of the entire Brillouin zone, we report measurements of their dispersion[2]. These findings are discussed in the framework of the dynamical magnetoelectric coupling theory, where the Dzyaloshinskii-Moriya interaction plays a central role.

[1] Petit S. et al., Phys. Rev. Lett., 99, 266604 (2007)
[2] Pailhès S. et al., Phys. Rev. B, in press

Th-D-3.2-06

The effect of sintering conditions on structural and magnetic properties of $La_{0.7}Ca_{0.3}Mn_{0.99}Fe_{0.01}O_3$

Il Jin Park, Sun Chun Hong, Chul Sung Kim
Kookmin University, Seoul 136-702, Korea

We present the magnetic properties tuned by sintering conditions of The effect of sintering conditions on structural and magnetic properties of $La_{0.7}Ca_{0.3}Mn_{0.99}Fe_{0.01}O_3$, prepared by sol-gel method. The samples were annealed at 1000, 1200, 1400 °C for 4 h in air. The samples are of single phase with a perovskitelike *Pnma* structure as confirmed by x-ray diffractometer with Cu-$K\alpha$ radiation and analyzed by Rietveld refinement. There are no significant changes on lattice parameter by change in sintering conditions. Magnetic properties and magnetic structures were performed with vibrating sample magnetometer and Mössbauer spectroscopy. Temperature dependence of magnetization shows different shape which affected by changes of sintering temperatures. With increase of sintering temperatures, the gradient of magnetization curves drop more sharply but the Néel temperature decreases. The zero field cooling and field cooling magnetization dependences show a hysteresis indicating for the first order character of ferromagnetic-paramagnetic phase transition.

Th-D-3.2-07

The magnetic structure of $YMnO_3$ investigated by μSR under pressure.

D. Andreica[1], A. Amato[2], R. Bertrand[3], M. Janoschek[3,4], S.N. Gvasaliya[3], T. Lancaster[5], S.J. Blundell[5], K. Conder[6], E. Pomjakushina[3,6], M.L. Brooks[5], P.J. Baker[5], D. Prabhakaran[5], W. Hayes[5], F.L. Pratt[7], D. Roxana[1], C. Rusu[1]
[1] *Faculty of Physics, Babes-Bolyai University, 400084 Cluj-Napoca, Romania*
[2] *Lab. for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen, PSI, Switzerland*
[3] *Laboratory for Neutron Scattering, ETHZ and Paul Scherrer Institut, CH-5232 Villigen, Switzerland*
[4] *Technische Universität München, Physics Department E21, D-85747 Garching, Germany*
[5] *Clarendon Laboratory, Department of Physics, Oxford University, Parks Road, Oxford, OX1 3PU, United Kingdom*
[6] *Laboratory for Developments and Methods, Paul Scherrer Institut, CH-5232 Villigen, Switzerland*
[7] *ISIS Facility, Rutherford Appleton Laboratory, Chilton, Oxfordshire OX11 0QX, United Kingdom*

The magnetic structure of the hexagonal manganite $YMnO_3$ is still a subject of debate in the literature. Moreover, the fact that the magnetic moment, obtained from neutron scattering under pressure epxeriments decreases with the increase of the applied pressure while T_N increases steadily with pressure (μSR under pressure experiment on a polycrystal), indicates a delicate balance of competing interactions in this system.

Here we present our recent results obtained from μSR experiments at ambient and under applied pressure, performed on a single crystal. We found that the local field at the muon site, which is proportional to the sublattice magnetization, increases with the applied pressure, in contrast with the results of neutron scattering under pressure experiments. From a detailed analysis of the μSR data we were able to determine the muon site in $YMnO_3$ and to shed more light on the controversy about its magnetic structure.

Th-D-3.2-08

Non-collinear antiferromagnetic structure in PrCuAl

Pavel Javorský[1], Jiří Kaštil[1], Olivier Isnard[2]
[1] *Charles University, Faculty of Mathematics and Physics, Department of Condensed Matter Physics, Ke Karlovu 5, 121 16 Prague 2, The Czech Republic*
[2] *Institut Néel , CNRS associé à l'Université J. Fourier, Boîte F , BP 166, 38042 Grenoble cedex 9 , France*

We report on the magnetic structure in PrCuAl as determined by powder neutron diffraction. This compound crystallizes in the hexagonal ZrNiAl-type structure and the bulk measurements indicated an antiferromagnetic order in PrCuAl below $T_N = 8$ K. The ordering temperature is two times higher than expected from the de Gennes scaling and the ordering temperature of GdCuAl. The de Gennes scaling is nevertheless preserved in the PrCuAl-NdCuAl-SmCuAl sequence. The enhanced ordering temperature might eventually indicate different exchange mechanisms in the RCuAl compounds containing the light rare-earth atoms. Our neutron-diffraction data confirmed the antiferromagnetic order below 8 K and revealed the propagation vector (1/3, 1/3, 1/3). The Pr magnetic moments lie within the basal plane. This magnetic structure differs from antiferromagnetic structures observed in other RCuAl or RNiAl compounds that are characterized by (1/2, 0, q) propagation.

Th-D-3.2-09

Gyroscopic Dynamics of Vortices on the Domain Wall of Yttrium Orthoferrite*

Mikhail Chetkin, Yuliya Kurbatova, Tatyana Shapaeva
Physics Department of Moscow State University, Russia

Dynamics of antiferromagnetic vortices (AFMVs) on domain wall (DW) in the yttrium orthoferrite was investigated experimentally. Moving AFMV accompanied by solitary deflection waves (SDW), used for investigation of generation and nonlinear dynamics of AFMVs on the moving DW. From digital high speed real time photographs the DW velocity v, the AFMV velocity along DW u and the total AFMV velocity w were determined. The experimental dependence u(v) first grows nonlinearly, reaches a maximum, and then follows the relation $u^2 + v^2 = c^2$, where c is the spin wave velocity. The maximum on the u(v) curve shifts to higher velocities with increase of the AFMV topological charge†. The curves w(v) demonstrate a nonlinear increase and reach saturation at the level 20 km/s. The gyroscopic force in ortoferrites is proportional to Dzialoshynski field and was successfully used for description of experimental dependencies u(v) and w(v)‡.

*This work was supported by Russian Foundation for Basic Research No. 07-02-00832-a.
†M.V.Chetkin, Yu.N.Kurbatova, T.B.Shapaeva Gyroscopic Dynamics of Antiferromagnetic Vortices in the Orthoferrite Domain Wall. JMMM 2009 (in press)
‡A.K. Zvezdin, V.I. Belotelov, K.A. Zvezdin, JETP Letters, 87, (2008) 381 [Pis´ma Zh. Exp.Teor. Fiz., 87 (2008) 443].

Th-D-3.2-10

Sinusoidally Modulated Magnetic Structure of a Kondo Lattice Compound $CePd_5Al_2$

Y. F. Inoue[1], T. Onimaru[1], A. Ishida[1], K. Ohoyama[2], Y. Oohara[3], D. T. Adroja[4], A. D. Hillier[4], E. A. Goremychkin[4,5], T. Takabatake[1,6]
[1] *AdSM, Hiroshima University, Higashi-hiroshima 739-8530, Japan*
[2] *IMR, Tohoku University, Sendai 980-8577, Japan*
[3] *Neutron Science Laboratory, ISSP, University of Tokyo, Tokai 319-1106, Japan*
[4] *ISIS Facility, Rutherford Appleton Laboratory, Chilton Didcot,OX11 0QX,U.K.*
[5] *Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439, USA*
[6] *IAMR, Hiroshima University, Higashi-hiroshima 739-8530, Japan*

$CePd_5Al_2$ crystallizing in the tetragonal $ZrNi_2Al_5$-type structure exhibits antiferromagnetic(AF) orderings at $T_{N1} = 4.1$ K and $T_{N2} = 2.9$ K. Below T_{N2}, the isothermal magnetization in magnetic field $B \| c$ jumps at $B_{c1} = 1.3$ T. The magnitude of the jump at B_{c1} remains constant with decreasing temperatures down to 0.3 K. Above B_{c1}, magnetization linearly increases with increasing B and reaches the saturation value at $B_{c2} = 4.9$ T. This behavior is not consistent with an AF structure with an easy-axes along the c direction. The magnetic structure was determined by neutron diffraction technique, where the magnetic moments align along the c-axis with a sinusoidally modulated structure. The transition at T_{N1} may be a spin density wave transition due to nesting of flat Fermi surfaces. Inelastic neutron scattering measurements were also performed, which reveal a well defined crystal field excitation (CF) at 21 meV. A detained analysis of the data based on the CF model will be presented.