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## Neutron polarimetry investigation of CuO

Friday, 16 September 2011 11:45 (20 minutes)

This presentation will give a summary of the polarized neutron experiments that have been performed at the Paul Scherrer Institut using the MuPAD spherical neutron polarimetry (SNP) set-up on TASP, [1]. It will include a discussion of the approach taken to analysis and interpretation of polarimetry data recently gathered on the high temperature multi-ferroic CuO, [2].

SNP experiments polarize the neutron beam before the scattering event in the orthogonal directions,  $x$ ,  $y$  and  $z$ , and then measure the vector components  $(x, y, z)$  of the final polarization,  $P_f$ , to give the fullest amount of information about a magnetic structure. SNP experiments allow the extraction all of the interference terms between the magnetic and nuclear scattering and also between the different components of the magnetic interaction vector,  $M_{\perp} = (0, M_y, M_z)$ , where  $x$  is along  $Q$  and  $y, z$  define the Bragg plane, [2]. The SNP set-up uses a zero-field chamber to surround the sample in order that the scattered beam cannot precess about a guide field. MuPAD, used on TASP at PSI is the only SNP zero-field environment that does not need to be cryogenically cooled, [1, 2].

Recently, there has been particular interest in the measurement of the intensity created in a polarised neutron beam from the interference of the real and imaginary components that can be present in  $M_{\perp}$ . The intensity change only occurs when the magnetic structure is cycloidal or helical and these magnetic orders are a central theme in the study of type two multiferroic (MF) materials. Furthermore the increase in intensity is only observed when there is a single cycloidal domain, and the channel in which it is observed gives information about the handedness of the domain that is present.

This talk will present the very recent polarimetry measurements that have been made on CuO, which track the change of this intensity, and hence the cycloidal domain population as a function of electric field. The results indicate the strong coupling between the magnetic structure and the application of an electric field in this high TC multiferroic.

[1] M Janoschek, S Klimko, R Gaehler, B Roessli and P Boeni, Spherical neutron polarimetry with MuPAD, *Physica B*, 397, 125, (2007)

[2] T Kimura, Y Seiko, H Nakamura, T Siegrist and A P Ramirez, Cupric oxide as an induced-multiferroic with high-TC, *Nat Mater*, 7, 291, (2008)

[3] F Tasset, PJ Brown, E Lelievre-Berna, T Roberts, S Pujol, J Allibon and E Bourgeat-Lami, Spherical neutron polarimetry with Cryopad-II, *Physica B*, 267, 69, (1999)

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