Experimental report

19/07/2021

Proposal: 5-54-316 **Council:** 10/2019

Title: Magnetoelectric coupling in La0.67Sr0.33MnO3/ 0.7Pb (Mg1/3Nb2/3) O3-0.3PbTiO3 heterostructure as a function of thickness

Research area: Physics

This proposal is a new proposal

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Experimental team: Alexei VOROBIEV
Emmanuel KENTZINGER
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Local contacts: Alexei VOROBIEV
Thomas SAERBECK

Samples: La0.67Sr0.33MnO3/ 0.7Pb (Mg1/3Nb2/3) O3-0.3PbTiO3

Instrument	Requested days	Allocated days	From	To
D17	6	0		
SUPERADAM	6	5	24/08/2020	26/08/2020

Abstract:

Electric field manipulation of magnetism in oxide heterostructure has a broad playground with a great potential to impact magnetic data storage, spintronics and high – frequency magnetic devices. Most of the information storage device require high – density current to read or write the information stored in the magnetization. A structure where one could manipulate magnetization with an applied electric field would significantly reduce the switching power and energy dissipation. Since correlated complex oxides possess strong couplings between lattice, charge, spin and orbital degrees of freedom, one can explore the mechanism of magnetoelectric coupling (1). We deposited an artificial multiferroic heterostructure, which comprises of ferromagnetic thin film La0.67Sr0.33MnO3 – LSMO onto piezoelectric substrate 0.7Pb (Mg1/3Nb2/3) O3-0.3PbTiO3 – PMN-PT. By applying voltage, we plan to investigate how strain and switching polarization of ferroelectric PMN-PT would influence the magnetization of LSMO. In order to get access to the microscopic properties of this coupling, we need neutron reflectometry for probing magnetic depth profile of the resulting interface.

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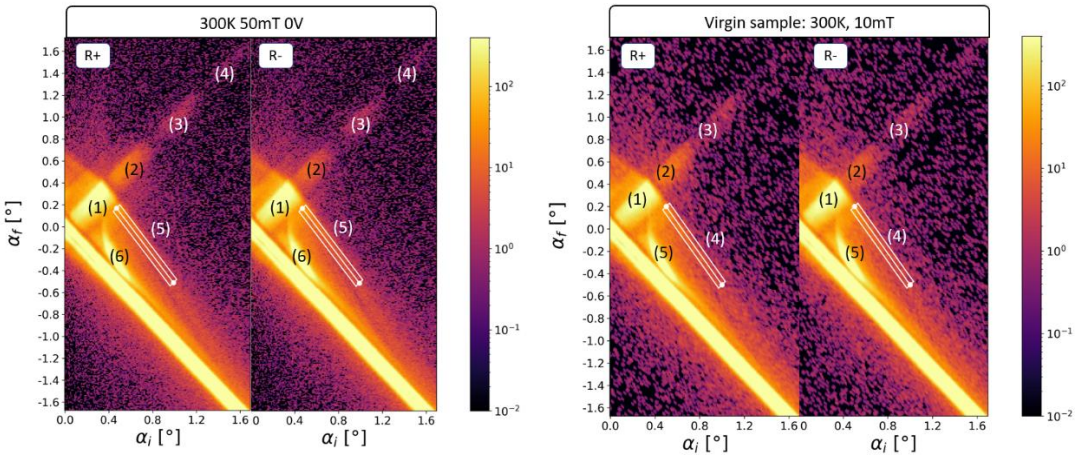
Experimental team: Tanvi Bhatnagar, Emmanuel Kentzinger, Patrick Schöffmann, Annika Stellhorn, Anirban Sarkar, Thomas Brückel

Local Contact: Alexei Vorobiev

Instrument: SUPERADAM

Experimental details:



The measurement plan was to perform PNR with full polarization analysis for 2 samples of LSMO/PMN-PT(001): virgin sample and sample that has been exposed to voltage at 2 different temperatures: 300K and 80K with applied magnetic field of 10mT and 50mT respectively. This experiment was performed remotely.

The idea behind this experiment was to investigate presence of any off-specular magnetic scattering as a function of voltage but due to time constraint, it was not possible to perform full polarization analysis over the complete detector area. The 2D maps obtained for 2 channels in PNR measurements performed at two temperatures shows some off-specular scattering. However, it is not possible to determine the origin of this off-specular scattering, i.e. whether it originates from interfacial roughness or from bulk nuclear or magnetic scattering.