



Internship proposal 2011-2012

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Topology and dynamics of ferroelectric polarization of oxide surfaces using a multi-scale experiment approach

Scientific project:

Ferroelectric oxide thin films (BaTiO₃, PbTiO₃, PZT) play a central role in many microelectronic and spintronic devices (capacitors, detectors, memories, switches) because of their piezoelectric, dielectric and information storage properties. The screening mechanisms controlling the topology of surface order and their dynamics (domain wall movement and polarization inversion), however, are not fully understood. The aim of the internship is to study the polarization topology as a function of screening and to investigate its dynamics.

A combination of photoelectron spectroscopy techniques will be used: high spatial, energy and time resolved photoemission and XPEEM spectromicroscopy, to understand the screening of the polarization charge in remanent or saturated states.

The samples will be single crystals or thin films grown by molecular beam epitaxy or pulsed laser deposition. Experiments will be carried out in laboratory and synchrotron environments.

The polarization dependent surface core level shifts will be compared with ab-initio theory using a multi-scale approach based on kinetic Monte Carlo and “coarse-graining”, providing the order parameter topology on the same scale as experiment.

The theoretical calculations are done in collaboration with G. Geneste (CEA-DAM)

Website: <http://iramis.cea.fr/spcsi/spectromicroscopy/>

Techniques in use :

Photoelectron spectroscopy (PES), Photoelectron emission microscopy (PEEM), Low energy electron microscopy (LEEM)

Applicant skills :

Strong background in solid state physics

Granted internship : yes (700 €/month)

C'nano IdF laboratory (France only) : yes

Possibility for a thesis : yes (type of grant : CEA CFR)