

MAP-fis Essay Proposal, 2015-2016

(please write in English)

Supervisor

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Title

Induced Functional Shifts of Nanometric regions at Materials Interfaces

Area

(*Materials, Optics, Condensed Theory, High Energy Theory,....*);

Materials:

multiferroic, magnetoelectric effect, strong correlated electrons materials, phase transition

Summary of Proposal

The leading objective of this study is the research and development of a technology able to design different nanoscale functional electronic elements into the surface of a single composite base material. The intended outcomes of this concept have a potential to drive a new pathway for the fabrication of microelectronic chips, simplifying or complementing the current multistep procedure.

The investigation will focus on the synergy of advanced microscopy methods for comprehensive characterization and manipulation of a specific selection of strong correlated electron (SCE) materials having an underlying mechanism of concomitance in nanometric regions of different metastable states. Furthermore, these materials rely in compositions near the threshold of pertinent phase transitions, which lead to contrasting responses of electric/ magnetic/ structural properties.

The research project will pursue the exploration of combinations and architectures in a concise set of SCE materials, in order to establish the accurate composition, structure, interfaces and surface features which uphold the concomitance of the different metastable states, and concurrently under the appropriate local nanolithography stimulation, promote a distinct local segregation and stabilization of one of these different states at normal room temperature conditions.

One of the challenges to be addressed is directed to reach the technological implementation stage, i.e.: the comprehensive identification, quantification and reproducibility of the ascribed phenomena in order to define precisely the conditions that ensure the intended phase shift stabilization and



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electronic functional performance in the material.

The idea under the scope of this project proposal is rooted in original proofs of concept attained from preceding scientific work developed by the proponent research team [1].

References

(to allow students first look at topic)

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