

PhD proposal (Marseille - France)

Laboratory : CINaM (UMR 7325) – Campus of Luminy - Marseille

PhD supervisor : Laurence MASSON (associate professor) laurence.masson@cinam.univ-mrs.fr

Topic: ***Synthesis of one-dimensional nanomagnets on nanopatterned substrates***

The fabrication of ultrahigh density nanostructures assemblies with exquisite control over the shape, size, composition and mesoscale organization and potential new magnetic, electronic or photonic properties has aroused considerable interest in the nanoscience scientific community in the last fifteen years. The PhD work consists to elaborate nanomagnets, especially using an innovative on-surface synthesis of covalent linked organic molecules on nanopatterned substrates. The work will focus on one-dimensional (1D) systems, for which peculiar unusual magnetic properties are expected. The candidate will work in the group SuN (Substrates for Nanosciences) composed of physicists in close collaboration with chemists (O. Siri's group) of the Laboratory.

The first part of the work concerns the synthesis in ultra-high vacuum (UHV) environment of chains composed of transition metals. Firstly, 1D nanostructures will be formed through the self-organized growth of transition elements (Co, Fe, Ni) on the nanopatterned substrate Si/Ag(110). In a second step, long coordination polymer chains will be obtained through co-evaporation of transition metals (Fe, Co, Ni) and organic molecules synthesized in the group of chemists. The first experiments will be carried out on the anisotropic Ag(110) surface and then on the nanopatterned substrate. The structural and electronic properties of the 1D nanostructures will be characterized *in-situ* by scanning tunneling microscopy (STM) and scanning tunneling spectroscopy (STS) which are powerful tools to study adsorbates covered conductive substrates at the atomic scale.

In a second step, the preliminary characterization of the magnetic properties of the 1D nanostructures will be done *ex-situ* in the Laboratory using a magneto-optical Kerr effect set-up after passivation of the deposit by a thin Au film. In-depth studies by X-ray Magnetic Circular Dichroism (XMCD) using synchrotron facility (Soleil-ESRF) will be carried out once the elaboration of the grown chains will be well controlled.

The "Centre Interdisciplinaire de Nanoscience de Marseille" or Marseilles Interdisciplinary Centre of Nanoscience - CINaM (personnel of around 180 - 60% staff, 20% doctorants, 10% post-doctorants and 10% visitors) is a mixed research Institute (CNRS-Aix-Marseille University) where physicists, chemists and biologists but also geologists work together on defined topics in Nanoscience and Nanotechnology.

The SuN group is recognized for the study of growth mechanisms in heterogeneous systems and the development of new strategies in the fabrication of different nanostructured surfaces. For the latter, many different approaches have been developed over the last decade and given rise to patents and publications in highly ranked journals: <http://sysweb.cinam.univ-mrs.fr/cinam/spip.php?page=perso&name=MASSON>

Candidates should hold a Master Degree with honours in physics. Knowledge in organic chemistry will be appreciated.

Applications should be emailed to Laurence Masson : laurence.masson@cinam.univ-mrs.fr

Deadline : **April, 30th 2015**

Funding : Doctoral School of Physics – Aix-Marseille University

<http://ed352.sciences.univmed.fr/contrat-doctoral>