MASTER DE PHYSIQUE ET APPLICATIONS - 2ème année
Spécialité Sciences des Matériaux et Nano-objets
International Nanomat Master Program

Internship proposal 2011-2012

Laboratory : Institut des NanoSciences de Paris

Address : BC 840 ; 4 Place Jussieu, 75252 Paris cedex 05, France

Laboratory director: Bernard Perrin

Internship supervisor: Martino Trassinelli

Phone : +33(0)1 44 27 62 30

e-mail: martino.trassinelli@insp.jussieu.fr

Characterization of MnAs films irradiated with Ne^{9+} ions

Scientific project:

The first-order phase transition near room temperature and the magnetic properties of bulk manganese arsenide (MnAs) have been intensely investigated in the last century. Bulk MnAs is a room temperature ferromagnetic and metallic compound up to T_C = 313 K where the first-order phase transition from hexagonal (α phase) to orthorhombic (β phase, MnP type) is accompanied by a ferromagnetic-paramagnetic transition.

The possibility of epitaxial growth of MnAs thin films on standard semiconductors such as GaAs has renewed interest in MnAs for spintronic research. The epitaxial strain disturbs the phase transition leading to the α–β phase coexistence to minimize the elastic energy. This temperature dependent structural modification induces the early appearance of the paramagnetic β phase at T = 273 K.
In the past years, MnAs film on GaAs has been widely studied to characterize these magneto-structural properties. Very recently, we discover that such peculiar characteristics can be modified by the implantation of fast (E_{kin} = 90 KeV) Ne^{9+} ions in the MnAs substrate with a consequent change of its magnetic property opening new perspectives.

In this internship we propose to continue these studies that have just started last months. This will consist of:
- operating the SIMPA ion source so as to bombard the MnAs sample with ions of different species and different charge state,
- and analyzing the properties of the sample after the ion implantation.

The interaction between ions and MnAs will be investigated through the study of the X-ray emission of the ions occurring during the collision. The properties of MnAs will be then measured using different techniques as magneto-optic Kerr effect, X-ray diffraction, Rutherford Back Scattering, …

Techniques in use: highly charge state ion production, X-ray spectroscopy, X-ray diffraction, magneto-optic Kerr effect, Magnetic-Force microscopy.
Applicant skills: Good basic skills in atomic physics and/or in material sciences

Granted internship : yes (_the official amount for an intership_€/month)
C'nano IdF laboratory (France only) : yes
Possibility for a thesis : yes (type of grant : _ED UPMC_____)