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

Internship proposal 2010-2011

Laboratory : Superconductivity and microwaves

Address : Dept. of Physics, Università Roma Tre, Via della Vasca Navale 84, I-00146 Rome, Italy

Laboratory director : Prof. Enrico Silva

Internship supervisor : Prof. Enrico Silva

Phone : +39 06 5733 7205 (room) / 7260 (lab)

e-mail: silva@fis.uniroma3.it

Electrodynamics of superconductor/ferromagnet multilayers at microwave frequencies.

Scientific project :

The competition of superconductivity and magnetism is a hot topic in the context of cuprates and oxypctinides. Despite its relevance, it is still not a well established phenomenon even in conventional materials. Here, we propose to investigate the behaviour of ferromagnet/superconducting multilayers in conventional materials such as (Nb)/ ferromagnet (S/F) heterostructures.
The effect of weak as well as strong F layers could be investigated and compared.
During this stage measurement of the transport properties at microwave frequencies of superconducting (Nb)/ ferromagnet (S/F) heterostructures will be performed. Aim is the study of:
(a) the electromagnetic penetration depth and its variation with the temperature, $\lambda(T)$;
(b) the response of quantized vortices (fluxons), nucleated as a consequence of an external magnetic field or self-generated as a consequence of the interactions with the F layers;
(c) the quasiparticle conductivity of the heterostructures below Tc (Meissner and mixed state);
(d) the temperature dependence of the critical fields as observed in microwave measurements.
Experimentally, either a Corbino disk (one of the very few setups in the world applied to the study of superconductors, and the only one in Italy) for broadband (2-20 GHz) measurements, and dielectric resonators for high resolution measurements at fixed frequencies (in the 5-15 GHz range) will be used.

A continuation can be envisaged, with possible interest on oxypnictides.

Techniques in use :
Microwave measurements (power and vector measurements); Cryogenics; Vacuum; Labview © automated data acquisition.

Applicant skills :
Disposition to experimental work, reasonable knowledge of superconductivity and/or magnetism

Granted internship : no
C'nano IdF laboratory (France only) : yes / no
Possibility for a thesis : yes , financial support possible after selection according to national rules.
Amount of the grant: approximately 13640 €/year (previdential contribution shall be deducted).