

Internship proposal 2009-2010

Laboratory : Superconductivity and microwaves	
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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. However, it is not a well established topic. Here, we propose to investigate the behaviour of ferromagnet/superconducting multilayers in conventional materials such as (Nb)/ ferromagnet (S/F) heterostructures.

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 T_c (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 three 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 (around 10-15 GHz) will be used. Observed novel phenomena, such as bistabilities in the vortex system, could be the subject of a related, but independent, specific stage.

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

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

Granted internship : yes

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).