

Internship proposal 2009-2010

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	

Pinning of flux lines in nanostructured superconductors: a very-high-frequency experimental study.

Scientific project :

Pinning of flux lines is an essential issue for practical applications of superconductors, in order to avoid the insurgence of losses due to the flux motion.

In high-T_c cuprates, this is a major issue: intrinsic properties (high operating temperatures, large anisotropy, small coherence length) conspire to make flux lines very flexible and hard to pin.

Recently, it has been discovered that specific inclusions (e.g., BaZrO₃) in the target from which films are grown, once deposited in the superconducting film, can self-assemble in the shape of quasi-columnar defects. This feature led to a very significant increase of the irreversibility line in YBa₂Cu₃O₇/BaZrO₃ thin films.

We propose here a microwave study of such materials: in fact, currents at very high frequencies induce extremely small oscillations of flux lines. Thus, one probe the single-vortex, small perturbation regime of the vortex matter. Most, if not all, the complications due to the rich physics of the flux lines in cuprates are avoided, and one can concentrate on the intrinsic features: steepness of the potential wells, quasiparticle scattering time and quasiparticle concentration within the vortex cores.

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).