welcome to the European Microkelvin Collaboration

CAPACITIES

MICROKELVIN Transnational Access Project Report

1. General information

Project number:	CNRS 5	
Project Title:	**Specific heat signatures of a Kosterlitz-Thouless transition**	
Lead scientist:[1]	**Title:**	Professor
	First name:	Javier
	Last name:	Rodriguez-Viejo
	Home institution:	Universitat Autonoma de Barcelona
Project scientist:	**Title:**	PhD
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	Last name:	Molina Ruiz
	Birth date:	02/04/1982
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	Research status/Position:	UAB PhD
	New User:[2]	yes
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[1] The lead scientist indicated here is expected to participate in the campaign as a user of the infrastructure.

[2] Indicate 'Yes' only if the user has never visited the infrastructure before this specific project, otherwise write 'No'.

2. Project information

Please, give a brief description of project objectives: (250 words max)	We performed heat capacity measurement on ultra-thin films of superconducting lead (Pb), quench condensed in situ in the calorimeter directly on the membrane sensor. We used the facilities of TA2-Grenoble, especially a specific experimental probe developed at the Institut Néel, as well as the nanofabrication facilities of NANOFAB. The thermal evaporation of lead, silver, and eventually of magnetic materials in situ is planned, which all will be fully characterized at low temperatures. The calibration of the quartz crystal is crucial to control the thickness of the thin films accurately. The highly sensitive heat capacity measurement has to work at very low temperatures, in order to follow the appearance of a peak versus temperature as the layer thickness is grown in situ. The major advantage of this method will be to be able to measure the Cp signature versus the thickness of the thin film without being obliged to open the measuring system. All the Cp measurements will be performed down to the lowest temperatures of the cryostat.
Technical description of work performed: (250 words max)	The crucibles have been installed in the low temperature probe. The quartz crystal has been calibrated from room temperature down to low temperatures. The calorimetric sensors (on a silicon membrane base) have been built at the Nanofab facility and very sensitive thermometers have been deposited for measurement. All the thermometer calibrations were completed. Evaporation of lead on a test sample has been done and a measurement of the evaporated film thickness has been performed a posteriori. A measurement of the heat capacity of a lead thin film has been carried out down to 0.5K. The characterization of the heat capacity jump of thick films (50nm) demonstrate that a clear phase transition will be observed even at very low thickness (below 0.5nm). The signal to noise ratio is largely favourable.
Project achievements (and difficulties encountered)[5]: (250 words max)	The first evaporations of lead at 4K have been performed in the calorimeter. The calibration of the quartz crystal microbalance has been done. We demonstrated also the possibilities for successive evaporations of material in quench-condensation conditions in the calorimeter, without having to warm up the system. The helium leaks have been checked and repaired. Each of the crucibles had to be independently leak tested before being mounted on the probe. Now the system is operational at 1K. The evaporation of a lead thin film has been done on a silicon membrane calorimetric sensor.

Expected publications and dates:	The plan is to publish the measurement technique in the Reviews of Scientific Instruments during 2012
Submission date of user group questionnaire:	18 October, 2011