welcome to the European Microkelvin Collaboration

CAPACITIES

Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	**AALTO26**	
Project Title:	**Superconducting graphene resonators**	
Lead scientist:[1]	**Title:**	Lecturer
	First name:	Saverio
	Last name:	Russo
	Home institution:	University of Exeter, School of Physics, Centre for Graphene Science
Host scientist:	**Title:**	Professor
	First name:	Pertti
	Last name:	Hakonen
	Home institution:	OV Lounasmaa Laboratory - Low Temperature Section, Aalto University, School of Science
Project scientist:	**Title:**	Mr.
	First name:	Daniel
	Last name:	Cox
	Birth date:	21/01/1990
	Passport number:	461907995
	Research status/Position:	Graduate student (MSc)
	New User:[2]	No
	Scientific Field:	Condensed matter (graphene)
	Home institution:	University of Exeter
	Is your home institution MICROKELVIN partner?	no
	Business address:	Centre for Graphene Science, School of Physics, University of Exeter
	Street:	Stocker Road
	PO Box:	
	City:	Exeter
	Zip/Postal Code:	EX4 4QL
	Country:	UK
	Telephone:	+44 (0)1392 264171
	Fax:	+44 (0)1392 264111
	E-mail:	dc287@ex.ac.uk
	Curriculum vitae (18 lines max): - Experience in creating, fabricating and measuring graphene devices in a clean environment including: exfoliation on different substrates (SiO2/PMMA) and with different exfoliation methods, fabrication using both photolithography and electron beam lithography with thermal evaporation of contacts, low and high temperature measurements, and annealing of samples.	

[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'.

	- Currently > 80% grade in lab work - Knowledge and some experience of characterization devices including transport measurements, Raman spectroscopy and other methods (Hall effect, etc.). - Use of various computational tools to analyse results (typically Octave, Origin, AutoCAD).		
	Five most recent publications:		
	1-		
Other participating scientists:[3]	**Name:**	**Position:**	**New User:**[2]
	1 Saverio Russo (http://emps.exeter.ac.uk/staff/sr330)	Lecturer	no
	2-		
	3-		

2. Project Information

Name of host infrastructure:	LTL, Aalto University			
Access provider / Infrastructure Director:	**Name:** prof. Pertti Hakonen		**E-mail address:** pertti.hakonen@aalto.fi	
Planned project dates:	**Start date:**	08/09/2012	**Completion date:**	30/09/2012

Project description (12 lines max):

Graphene is a unique two-dimensional, gapless semiconductor: the conduction and valence bands touch in two inequivalent K points, the Dirac points, where the density of states vanishes. However, the conductivity at the Dirac point remains finite. Indeed, it has been theoretically shown by M. Katsnelson and J. Tworzydlo et al. in 2006 that, in perfect graphene, the conduction occurs only via evanescent waves at the Dirac point. Mechanical graphene resonators have been actively investigated during the last few years. At LTL, we have adopted capacitive measurement methods for detection of nano-mechanical motion. Dissipation at high measurement frequencies is one of the unknown factors in employing these capacitive techniques for graphene resonators. One way to go around this problem is to employ proximity-induced superconductivity to reduce electrical losses. In this project we plan to develop superconducting graphene resonators and investigate their electrical and mechanical characteristics.

Scientific objectives of the project (12 lines max):

1. to construct graphene samples with proximity-induced supercurrents,
2. to observe the supercurrent and determine its dependence on the sample characteristics,
3. to compare ballistic junction models to the observed supercurrents, and
4. to investigate the interplay of mechanical motion and superconducting transport.

Technical description of work to be performed (20 lines max):

1. preparation and characterisation of monolayer graphene samples with superconducting contacts,
2. releasing the graphene sheets using an appropriate method, for example vapour-phase HF-etching,
3. characterization of the samples at DC at room temperature,
4. selection of good samples for low temperature measurements,
5. measurements in a dilution refrigerator,
6. obtain data on conductivity, supercurrents, and shot noise,
7. detect mechanical resonance using FM detection methods,
8. investigate coupling between mechanical motion and superconducting electrical transport,
9. compare FM detection to supercurrent resonance detection.

Of the above work list, items 1-2 will be performed using Micronova facilities, while items 3-9 will be carried out at LTL of Aalto University.

[3] Please list all participating user group members. Expand the table, if necessary.

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure?	No
If yes, please specify:	

Is this proposal submitted to any funding programmes?	No
If yes, please specify:	

The completed Application Form should be submitted to MICROKELVIN Management Office (**laitila@neuro.hut.fi**, fax +358-9-47022969)