welcome to the
European Microkelvin Collaboration

CAPACITIES

Report on the Transnational Access Activity carried out within MICROKELVIN

The eligibility of transnational access to a MICROKELVIN TA site implies the submission of the following:

1) The Certification of visit

The form “Certification of visit” must be completed and signed by the access provider in charge of the infrastructure and the leader of the project.

2) A TA project report

The form for the TA project report is contained within this document. It should be completed after project end by the group leader of the project. You must respect the limited number of words specified, longer descriptions will be rejected. Figures/tables may be attached at the end of the document. The document must be submitted in an editable format (doc, rtf).

3) A User group questionnaire

To enable the Commission to evaluate the Research Infrastructures Action, to monitor the individual contracts, and to improve the services provided to the scientific community, each project leader of a user-project supported under an EC Research Infrastructure contract is requested to complete a "user group questionnaire". The questionnaire must be submitted once by each user group to the Commission as soon as the experiments on the infrastructure come to end.

The user group questionnaire is not part of this document and must be completed on-line. It is accessible at:

http://cordis.europa.eu/fp7/capacities/questionnaire_en.html.

► **Please note that any publications resulting from work carried out under the MICROKELVIN T**

A activity must acknowledge the support of the European Community :

“The research leading to these results has received funding from the European Community’s Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 228464 (MICROKELVIN).”

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MICROKELVIN Transnational Access Project Report

1. General information

Project number:	**CNRS12**	
Project Title:	**Electron Transport Through Molecular Devices**	
Lead scientist:[1]	**Title:**	Dr.
	First name:	Luis
	Last name:	Hueso
	Home institution:	CIC Nanogune
Host scientist:[2]	**Title:**	Prof.
	First name:	Hervé
	Last name:	Courtois
	Home institution:	CNRS Grenoble
Project scientist:[3]	**Title:**	MSc
	First name:	Emmanuel
	Last name:	Masourakis
	Birth date:	June 6th, 1987
	Passport number:	AH 3957924
	Research status/Position:	Research assistant
	New User:[3]	
	Scientific Field:	Quantum nano-electronics
	Home institution:	NanoGUNE San Sebastian
	Is your home institution MICROKELVIN partner?	No
	Business address:	
	Street:	Tolosa Hiribidea, 76
	PO Box:	
	City:	E-20018 Donostia – San Sebastian
	Zip/Postal Code:	
	Country:	Spain
	Telephone:	943574000
	Fax:	
	E-mail:	Luis Hueso <l.hueso@nanogune.eu>

1 The lead scientist indicated here is expected to participate in the campaign as a user of the infrastructure.
2 The host scientist is supervising the work of the visiting project scientist at the infrastructure.
3 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)	The project deals with the fabrication of single electron devices based on gold nano-particles. The first step is to control as best as possible the placement of a single nanoparticle within a sub-10 nm gap between two of the electrodes of the 3 terminal device. A desired deposition method should not alter the electrical characteristics of the device and especially the electrical coupling between the device terminals and the deposited nanoparticle. In addition, we aim to control the concentration of deposited nanoparticles as well as the exact cite to which they are attached. Finally, the deposition method must be easily reproducible.
Technical description of work performed: (250 words max)	The method involves the functionalization of the device surface with aminopropyltriethoxysilane (APTES) and the subsequent deposition of Au nanoparticles by submerging the entire device into solution. The silane end groups of APTS bond to and protonate the SiO_2 substrate and Au device terminals, creating a layer of positive charge on the functionalized areas of the surface. The Au nanoparticles used are coated with a thin layer of tannic acid making them negatively charged. When the device is submerged into a solution of Au nanoparticles the protonated surface will attract the negatively charged nanoparticles. The protonation of the surface (and subsequently the amount of nanoparticles attracted to it) can be controlled by regulating the pH of the solution. The deposition of APTS was examined using two methods. Primarily a simple spin coating process was used to functionalize the surface. The second method involved a process by which Ar gas was flown through the APTS solution and then proceeded to the surface of the device gradually creating a layer of APTS on the entire surface of the device. Finally, in an attempt to circumvent the use of APTS, we examined an electro-deposition method for attracting the nanoparticles to the surface. In this method, a voltage is applied across the two terminals of the device while it is submerged in the solution. The process causes the nanoparticles to be deposited on the two terminal and in the area between.
Project achievements (and difficulties encountered):[5] (250 words max)	The spin coating method was the simplest to apply. The challenge with this method however lies in creating a sufficiently thin layer. A thick layer will cause the electrical coupling between the device terminals and the nanoparticles to be too weak. Even though good functionalization was achieved, the coupling was such, that the method was finally disregarded. The Ar gas method, although more complicated to control and reproduce, gave much thinner (better) layers. In addition functionalization seemed to occur more selectively, allowing the nanoparticles to be concentrated on the functionalized areas and be absent in non-functionalized areas. One of the main challenges consisted of preventing the polymerization of APTS on the substrate surface after the deposition. This was attempted by regulating the parameters of the gaseous deposition. The electro-deposition method appeared to work quite well in attracting nanoparticles to a specific location. Unfortunately, in this method it seemed to be very hard to control the concentration of deposited nanoparticles.
Expected publications	

and dates:	
Submission date of user group questionnaire:	

Completed Project Reports should be returned to MICROKELVIN Management Office (Leena.Meilahti@tkk.fi, Fax: +358 9 4512969).