



## **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](http://cordis.europa.eu/fp7/capacities/questionnaire_en.html).

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► **Please note that any publications resulting from work carried out under the MICROKELVIN TA 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)."**



## MICROKELVIN Transnational Access Project Report

### 1. General information

<b>Project number:</b>	<b>Lancaster 15</b>	
<b>Project Title:</b>	<b>Ultralow temperature properties and thermometry in mesoscopic structures</b>	
<b>Lead scientist:</b> <sup>1</sup>	<b>Title:</b>	Dipl. Phys.
	<b>First name:</b>	Florian
	<b>Last name:</b>	Forster
	<b>Home institution:</b>	Dipl. Phys.
<b>Host scientist:</b> <sup>2</sup>	<b>Title:</b>	Dr.
	<b>First name:</b>	Richard
	<b>Last name:</b>	Haley
	<b>Home institution:</b>	University of Lancaster, Lancaster, United Kingdom
<b>Project scientist:</b> <sup>3</sup>	<b>Title:</b>	Dipl. Phys.
	<b>First name:</b>	Florian
	<b>Last name:</b>	Forster
	<b>Birth date:</b>	16.10.1986
	<b>Passport number:</b>	LF08ZFKMG
	<b>Research status/Position:</b>	PhD-student
	<b>New User:</b> <sup>4</sup>	No
	<b>Scientific Field:</b>	Nanophysics, Solid State Physics
	<b>Home institution:</b>	LMU Munich
	<b>Is your home institution MICROKELVIN partner?</b>	No
	<b>Business address:</b>	Fakultät für Physik, Ludwig-Maximilians-Universität
	<b>Street:</b>	Geschwister-Scholl-Platz 1
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<sup>1</sup> The lead scientist indicated here is expected to participate in the campaign as a user of the infrastructure.

<sup>2</sup> The host scientist is supervising the work of the visiting project scientist at the infrastructure.

<sup>3</sup> The project scientist is the person who will be visiting the infrastructure.

<sup>4</sup> Indicate 'Yes' only if the user has never visited the infrastructure before this specific project, otherwise write 'No'.

## 2. Project information

<p><b><u>Please, give a brief description of project objectives:</u></b> (250 words max)</p>	<p>A major goal of the MICROKELVIN project is to develop technology to better enable the cooling of electronic devices and nanocircuits to temperatures below 1 mK. For this purpose a new EU Access Facility machine was recently built at Lancaster. A major obstacle to cooling electronic devices is heat generated by noise transmitted through electrical leads. To address this, sophisticated wiring/filter protocols and designs developed by Stefan Ludwig's group in Munich are being implemented in the new machine at Lancaster. The Ludwig group have also developed high quality low temperature measurement techniques for nanostructures which they produce in-house. This project aims to perform the first ultralow temperature measurements on nanostructures built in Munich. To achieve this, Stefan Ludwig and Florian Forster require several visits to the Lancaster Access Facility to further develop the necessary measurement techniques and thermometry and to perform the preliminary measurements.</p> <p>The primary scientific and technologic objective of this collaborative project is to investigate nanoelectronic circuits in a hitherto unrivalled range of ultralow temperatures. This will allow us to reach lower energy scales and go well beyond the present state-of-the-art to investigate collective and phase sensitive quantum phenomena such as: mesoscopic interferometry effects; quantum Hall phases; the Kondo effect in coupled quantum dots; the 0.7 anomaly in quantum point contacts; and the hyperfine interaction between confined electrons and many nuclear spins. One of our main efforts will be to study coherent dynamics and entanglement in semiconductor-based quantum information circuits at ultralow temperatures. The combination of expertise in ultralow temperature physics in Lancaster and low temperature nanoelectronic measurements in Munich provides the framework for a successful collaboration. Nanostructures will be produced and initially characterised in Munich, while the final ultralow temperature measurements will be performed in Lancaster.</p>
<p><b><u>Technical description of work performed:</u></b> (250 words max)</p>	<p>This visit of Stefan Ludwig and Florian Forster at Lancaster University was devoted to an exchange of skills and technology between Munich and Lancaster and intensive planning of the ongoing project. The goal of the visit was to boost the progress of the project in order to enable first measurements on semiconductor chips scheduled to start in mid August. Important aspects were the optimization of the wiring which will include a large number of customized electric filters and of the compatibility between the technology developed in Munich with that being built for the dilution refrigerator in Lancaster.</p> <p>In detail we (i) planned and optimized the wiring, (ii) developed a concept for low-pass filters customized for the existing system and the planned experiments, (iii) developed a design for the first generation of sample hold-</p>

	<p>ers, and (iv) developed a detailed schedule for the planned experiments.</p> <p>The points (i-iii) are now being pursued in Lancaster while Florian Forster is producing and testing the proper samples for the first experiments in Munich.</p>
<p><b><u>Project achievements (and difficulties encountered):</u></b><sup>5</sup> (250 words max)</p>	<p>This visit of Florian Forster and Stefan Ludwig in Lancaster was an important step towards the future development of the new Lancaster facility for studying nanoelectronic circuits at ultralow temperatures. We now implement the planned structures and activities. We fully expect to be able to present first experimental results on semiconductor nanostructures at ultralow temperatures in the fall of this year.</p>
<p><b><u>Expected publications and dates:</u></b></p>	<p>We expect to be able to present first publications in 2014.</p>
<p><b><u>Submission date of user group questionnaire:</u></b></p>	<p>July 18, 2013</p>

Completed Project Reports should be returned to MICROKELVIN Management Office  
([Sari.Laitila@aalto.fi](mailto:Sari.Laitila@aalto.fi), Fax: +358 9 47022969).

Please complete and sign the form and send it by email or fax to the MICROKELVIN Management Office (leena.meilahti@tkk.fi, Fax No.: +358 9 4512969)

## CERTIFICATION OF VISIT at MICROKELVIN Transnational Access Site

I herewith confirm that the following project was carried out at our Transnational Access Site

(Name of the Site) LANCASTER UNIVERSITY

in the context of MICROKELVIN Transnational Access:

(Name of the Project) ULTRALOW TEMPERATURE INSTRUMENTS AND THERMOMETRY  
IN MICROSCOPIC STRUCTURES

The amount of access<sup>1</sup> delivered to the project group (project users) is as follows:

	Participant name	Duration of stay (start – end date)	Amount of access <sup>2</sup>
Project leader:	Dr Stefan Ludwig		
Project user 1:	Florian Forster	24/4/13 – 26/4/13	3
Project user 2:			
Project user ... <sup>3</sup>			
Total amount of access delivered to project group:			3

Lancaster 15/7/13  
Location and date

S. Fisher  
Signature of access provider  
**Prof Shaun Fisher**

München 15/7/13  
Location and date

[Signature]  
Signature of project leader  
**Dr Stefan Ludwig**

Completed Certification of Visit should be returned to MICROKELVIN Management Office  
([sari.laitila@aalto.fi](mailto:sari.laitila@aalto.fi), fax: +358 9 47022969)

<sup>1</sup> TKK Helsinki, CNRS Crenoble, or Lancaster University

<sup>2</sup> The amount of access is defined as the time, in days, spent by the user at the infrastructure for this project, including weekends and public holidays (e.g., a scientist who spent 5 days at the infrastructure must indicate '5'). The total amount of access of the project group is the sum of access days of each project user.

<sup>3</sup> Please, expand if necessary