



## Application Form for MICROKELVIN Transnational Access Project

### 1. General Information

<b>Project number:</b>	LANCASTER 17	
<b>Project Title:</b>	Ultra-low temperature MEMS	
<b>Lead scientist:</b> <sup>1</sup>	<b>Title:</b>	Dr
	<b>First name:</b>	Eddy
	<b>Last name:</b>	Collin
	<b>Home institution:</b>	Institut Néel - CNRS
<b>Host scientist:</b> <sup>2</sup>	<b>Title:</b>	Prof.
	<b>First name:</b>	Shaun
	<b>Last name:</b>	Fisher
	<b>Home institution:</b>	Lancaster University
<b>Project scientist:</b> <sup>3</sup>	<b>Title:</b>	Dr
	<b>First name:</b>	Eddy
	<b>Last name:</b>	Collin
	<b>Scientific Field:</b>	Ultra-low temperature physics
	<b>Home institution:</b>	Institut Néel - CNRS
	<b>Is your home institution MICROKELVIN partner?</b>	yes
	<b>Business address:</b>	
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	Zip/Postal Code:	38042
	Country:	France
	Telephone:	+33476887831
	Fax:	+33456387087
	E-mail:	Eddy.collin@grenoble.cnrs.fr
	<b>Curriculum vitae (18 lines max):</b>	<b>Dr. Ing. Eddy Charles Eric Collin</b> Born 26/08/1975 Married, 2 children French-German nationality
		1998 Master in Physics + Engineering degree in Physics. 1999-2001 PhD in ultra-low temperature physics, "Effects of disorder on 2D and superfluid <sup>3</sup> He" with Yu.M. Bunkov and H. Godfrin, Grenoble, France. 2002 Post-doc. "Electrons on Helium" with M.J. Lea, Royal Holloway London, UK. 2003-2004 Post-doc. "Quantum computing with superconducting qubits" with D. Estève and D. Vion, at the Quantronics group, CEA Saclay, France. Since Nov. 2004 Researcher (CR) at the Institut Néel, CNRS Grenoble.
		- Participation in European research projects and networks: <i>COSLAB, Surface electrons on mesoscopic structures, Squbit2</i> - Participation in European winter schools on cryogenics: <i>Cryocourse</i>
	<b>Five most recent publications:</b>	
		1- "In-situ comprehensive calibration of a tri-port nano-electro-mechanical

<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.

	device”, E. Collin, M. Defoort, K. Lulla, T. Moutonet, J.-S. Heron, O. Bourgeois, Yu.M. Bunkov, H. Godfrin, Rev. Sci. Instrum. <b>83</b> , 045005 (2012).		
	2- “Audio mixing in a tri-port nano-electro-mechanical device”, M. Defoort, K. Lulla, J-S. Heron, O. Bourgeois, E. Collin, and F. Pistolesi, Appl. Phys. Lett. <b>99</b> , 233107 (2011). <i>Article selected for the December 19, 2011 issue of:</i> Virtual Journal of Nanoscale Science & Technology, <a href="http://www.vjnano.org">http://www.vjnano.org</a>		
	3- “Nonlinear parametric amplification in a tri-port nanoelectromechanical device”, E. Collin, T. Moutonet, J.-S. Heron, O. Bourgeois, Yu. M. Bunkov, H. Godfrin, Phys. Rev. B <b>84</b> , 054108 (2011).		
	4- “A tunable hybrid electro-magnetomotive NEMS device for low temperature physics”, E. Collin, T. Moutonet, J.-S. Heron, O. Bourgeois, Yu.M. Bunkov, H. Godfrin, J. of Low Temp. Phys., Vol. <b>162</b> , 653 (2011)		
	5- “Addressing geometric non-linearities with cantilever MEMS: beyond the Duffing model”, E. Collin, Yu.M. Bunkov, H. Godfrin, Phys. Rev. B vol. <b>82</b> , 235416 (2010).		
<b><u>Other participating scientists:</u></b> <sup>4</sup>	<b>Name:</b>	<b>Position:</b>	<b>New User:</b>
	1- Martial Defoort	PhD student	<a href="#">yes</a>
	2- Henri Godfrin	Dir. of research CNRS	<a href="#">yes</a>

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<sup>4</sup> Please list all participating user group members. Expand the table, if necessary.

## 2. Project Information

<b>Name of host infrastructure:</b>	Lancaster University Physics Department			
<b>Access provider / Infrastructure Director:</b>	Name: Shaun Fisher		E-mail address: s.fisher@lancaster.ac.uk	
<b>Planned project dates:</b>	Start date:	[17/06/2013]	Completion date:	[22/06/2013]
<b>Project description (12 lines max):</b> The project aims at studying micro-electro-mechanical devices (MEMS) at ultra-low temperatures. In these extreme conditions, we want to measure their own mechanical properties (dissipation, nonlinear characteristics) together with their interaction with ultra-cold liquid $^3\text{He}$ .				
<b>Scientific objectives of the project (12 lines max):</b> The mechanical structures we want to study are goalpost-shaped silicon devices that mimic vibrating wires. Their properties have been very well characterized down to 1 K in vacuum, but not lower. As far as mechanics are concerned, there are two issues:  - a technical issue that aims at demonstrating that these devices are indeed extremely good oscillators at very low temperatures, far below 1 K (i.e. high Q, small nonlinearities, easy to detect a signal). This is mandatory for the scientific issue that is concerned with the interaction between the MEMS and liquid $^3\text{He}$ .  - a scientific issue that aims at understanding the sources of dissipation and nonlinearity. The dissipation issue is a topical subject linked to the physics of glasses, and dissipation in nano-mechanical structures.  A second scientific objective is to study the interaction between the MEMS and liquid $^3\text{He}$ . This has never been done before, and we hope to demonstrate an unprecedented resolution in the measurement of the fluid viscosity. In the superfluid case, this would lead to extreme resolution for thermometry and bolometry. Such a sensitivity should also prove useful in the study of quantum turbulence.				
<b>Technical description of work to be performed (20 lines max):</b> High quality MEMS devices have been characterized in Grenoble. They will be mounted in a $^3\text{He}$ cell on a demagnetization cryostat in Lancaster. Measurements of the mechanical properties will be performed as a function of temperature and fluid parameters (pressure P and magnetic field B). The standard magnetomotive (i.e. vibrating wire like) technique shall be used. The analysis will enable us to extract the oscillator's characteristics, and its interaction with the fluid, in both normal and superfluid states.				

## 3. Joint Proposals / Funding

<b>Is this project in collaboration with other (concurrent) projects at the infrastructure?</b>	<b>No</b>
If yes, please specify:	
<b>Is this proposal submitted to any funding programmes?</b>	<b>No</b>
If yes, please specify:	

The completed Application Form should be submitted to MICROKELVIN Management Office ([mari.kaarni@aalto.fi](mailto:mari.kaarni@aalto.fi), fax +358-9-47022969)