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 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)."**

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MICROKELVIN Transnational Access Project Report

1. General information

Project number:	AALTO 18	
Project Title:	**Andreev Scattering of Quasi-particles in Superfluid Helium 3-B**	
Lead scientist:[1]	**Title:**	Professor
	First name:	Carlo
	Last name:	Barenghi
	Home institution:	Newcastle University, UK
Host scientist:[2]	**Title:**	Professor
	First name:	Nikolai
	Last name:	Kopnin
	Home institution:	
Project scientist:[3]	**Title:**	Doctor
	First name:	Nugzar
	Last name:	Suramlishvili
	Birth date:	23/09/66
	Passport number:	08AH90486
	Research status/Position:	Research Associate
	New User:[4]	Yes
	Scientific Field:	Superfluid ^{3}He, Quantum Turbulence in ^{3}He-B
	Home institution:	Newcastle University
	Is your home institution MICROKELVIN partner?	No
	Business address:	
	Street:	School of Mathematics and Statistics, Newcastle University, Herschel Building
	PO Box:	
	City:	Newcastle upon Tyne
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	Country:	United Kingdom
	Telephone:	+44 (0)191 222 8327
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	E-mail:	n.suramlishvili@ncl.ac.uk

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 The project scientist is the person who will be visiting the infrastructure.

4 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)	Further progress of our project requires the development of numerical models based on deeper understanding of interactions between quasi-particles and quantized vortices in ^{3}He-B. During his visit, Dr Suramlishvili's first objective was to discuss with Professor Nikolai Kopnin and his colleagues within the Helium Theory Group the problem of the influence of vortex core states on the outcome of reflected quasiparticles. It is hoped that incorporating the core structure and their bound states into our numerical model will make it more realistic. The second objective is to apply our numerical method to the particular geometry corresponding to recent experiments, performed by Prof. Matti Krusius and his colleagues within the Rota Group, where the vortex structure is created by rotating the ^{3}He-B sample at constant angular velocity and the line density, orientation and spatial extent of the vortices are well defined. This may help to interpret the existing experimental data and to create a better link between theory and future experiments. It is also hoped that these discussions will lead to collaborative research between Newcastle and Aalto Universities.
Technical description of work performed: (250 words max)	The Andreev reflection technique is based on the fact that the dispersion curve E (p) of quasiparticles is tied to the reference frame of the superfluid, so, in a superfluid moving with velocity v_S , the dispersion curve becomes $E(p) + p \cdot v_S$, where p is the momentum. $E(p)$ plays the role of a Hamiltonian. The semi-classical Hamilton's equations describing the propagation of ballistic thermal excitations in the velocity field of a three dimensional configuration of quantized vortices are solved with a code, which is variable step and variable order implementation in Fortran programming language of the Numerical Differentiation Formulas and particularly efficient for solving stiff problems. The superfluid velocity is given by the Biot-Savart Law and is calculated by means of the vortex filament method using periodic boundary conditions. During the visit the following work was performed: 1) Seminar talk: "Numerical simulations of the interaction between quasiparticles and three-dimensional vortex structures in ^{3}He-B". 2) We had useful discussions with Professors N. Kopnin and G. Volovik concerning the semi-classical method used in the numerical code. 3) We discussed the possible models of vortex core bound states with Professor N. Kopnin. 4) We discussed the possible numerical models of past and future

	experiments with Dr. V. Eltsov and J. Hosio.
Project achievements (and difficulties encountered)**:**[5] (250 words max)	1) We received expert advice from Professor Kopnin and his colleagues concerning the vortex core structure and quasiparticle bound states in order to incorporate them in the numerical code. (The process of implementation of the corresponding part of the code is in progress). 2) We gained information on the design of the experiments in order to make the existing numerical model as close as possible to the real experimental conditions and to implement the code modelling the quasiparticle gas in the presence of rectilinear vortices. (The process of implementation of the code is in progress).
Expected publications and dates:	▪ ▪
Submission date of user group questionnaire:	

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