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:	**AALTO22**	
Project Title:	**Studies of quantum turbulence in superfluid 3He under rotation**	
Lead scientist:[1]	**Title:**	**Dr.**
	First name:	**Carley**
	Last name:	**Paulsen**
	Home institution:	**CNRS**
Host scientist:[2]	**Title:**	**Dr.**
	First name:	**Vladimir**
	Last name:	**Eltsov**
	Home institution:	**Aalto University**
Project scientist:[3]	**Title:**	**Dr.**
	First name:	**Martin**
	Last name:	**Jackson**
	Birth date:	**18/03/85**
	Passport number:	**502557209**
	Research status/Position:	**Post-doctoral researcher**
	New User:[4]	**Yes**
	Scientific Field:	
	Home institution:	**CNRS**
	Is your home institution MICROKELVIN partner?	☒ Yes ☐ No
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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)	Superfluid 3He under rotation provides a unique environment for quantum turbulence studies. The main topic of this project is the influence of polarization of vortex lines, which can be affected by rotation, on the behaviour of quantum turbulence at very low temperatures. The ultimate goal is to understand how the polarization affects the turbulence build-up and decay as well as the processes of energy transfer and dissipation.
Technical description of work performed: (250 words max)	Measurements of the coherent magnon states in a cylindrical sample of superfluid 3He-B during modulated rotation were made at temperatures between 0.15 and 0.2 mK. Modulation causes depolarization of vortex lines which was expressed and measured in terms of the frequency shifts of the magnon states. It was controlled by the duration and amplitude of the modulation. After stopping the modulation, the rotation velocity was changed to a new level and the decay of the vortex configuration to the equilibrium state was observed. It was found that the decay proceeds in 2 steps: First for a long time the vortex polarization remains low, indicating that global-scale turbulent flow is still present in the sample and only then polarization restores in a process which probably involves individual vortex lines and thus is relevant for the decay of Kelvin-wave turbulence. We measured these two decay times as a function of temperature, amplitude of the modulation, and of the final rotation velocity.
Project achievements (and difficulties encountered):[5] (250 words max)	The main finding is that the first decay time is proportional to the global flow energy, stored in the system after oscillations have finished. The energy can be calculated from the difference of the average velocity during oscillations and the final velocity, provided that the oscillation frequency is not close to the inertial wave resonances and thus the energy of the inertial wave can be neglected. From the value of the hydrodynamic energy and the measured decay time we can find the decay rate of the polarized quantum turbulence at ultra-low temperatures. At these temperatures it is expected that the decay occurs via the Kelvin-wave cascade. Given that vortices in our experiment are strongly polarized we can assume that each of them acts individually in dissipation and thus dissipation due to the Kelvin-wave cascade on a single vortex can be measured for the first time. This is an important achievement since both theory and numerical calculation of vortex dynamics so far are incapable of giving a reliable prediction of this effect.
Expected publications and dates:	Paper in Physical Review B in the first half of 2013.
Submission date of user group questionnaire:	03/10/2012

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