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:	AALTO25	
Project Title:	**Relaxation of magnon Bose-Einstein condensates in superfluid 3He-B**	
Lead scientist:[1]	**Title:**	Professor
	First name:	Yuriy
	Last name:	Bunkov
	Home institution:	Institute Neél, CNRS, Grenoble, France
Host scientist:[2]	**Title:**	Dr.
	First name:	Vladimir
	Last name:	Eltsov
	Home institution:	O.V. Lounasmaa Laboratory, Aalto University
Project scientist:[3]	**Title:**	Professor
	First name:	Yuriy
	Last name:	Bunkov
	Birth date:	29.08.1950
	Passport number:	08AA26721
	Research status/Position:	Directeur de Recherches at CNRS
	New User:[4]	No
	Scientific Field:	NMR, vortices, and superfluid dynamics
	Home institution:	Institute Neél, CNRS, Grenoble, France
	Is your home institution MICROKELVIN partner?	Yes
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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)	Long-lived coherent spin precession of 3He-B at the lowest temperatures below 0.2 Tc has been interpreted as Bose-Einstein condensation of magnon quasiparticles in the potential well formed by the order-parameter texture in the applied static magnetic field [1]. As the temperature decreases, the life time of such condensates rapidly increases to minutes. Using the rotating cryostat at the LTL we can bring the condensate in contact with quantized vortex lines or with the free surface of the 3He-B sample. The question we want to answer is whether vortex-core-bound or surface-bound fermionic states in 3He-B leave a signature in the relaxation properties of the magnon condensates. Interest in these states has significantly increased recently owing to the prediction that these fermionic states are at zero-energy possessing the Majorana character. [1] A. Autti, Yu.M. Bunkov, V.B. Eltsov, P.J. Heikkinen, J.J. Hosio, P. Hunger, M. Krusius, G.E. Volovik, *Self-trapping of magnon Bose-Einstein condensates in the ground state and on excited levels: from harmonic to box-like confinement*, Phys. Rev. Lett. **108**,145303 (2012).
Technical description of work performed: (250 words max)	The goal is to develop a model which describes the effect of the bulk quasiparticles on the relaxation time. This contribution can then be subtracted from the measured dependences. The final objective is to examine the additional relaxation which is caused by zero-energy states, to reveal the signatures of bound fermion states with Majorana charater. The relaxation rate of magnon condensates depends on the exact profile of the trapping potential. Thus the work includes two stages: First, the trapping potential is determined. For this the spectroscopy of magnon levels in the trap is used and the appropriate potential, which produces the same level positions, is calculated for each of the relaxation measurements. Second, a numerical model of the relaxation, which includes spin diffusion and possibly other relaxation sources, is developed. The results from the calculations will then be compared to the measured temperature dependences of relaxation in different trap configurations which can be controlled by applying rotation. We expect to find good agreement between experiment and calculation at higher temperatures and a deviation at lower temperatures. In this deviation we will look for a contribution, which depends on temperature as a power-law, the smoking gun signature for bound states with a zero state in the energy spectrum.
Project	Measurements on spin relaxation of magnon condensates in

achievements (and difficulties encountered)[5]: (250 words max)	various configurations have been performed in the rotating cryostat. A clear result has been obtained for the temperature dependence of the relaxation time associated with the bulk quasi-particles. Also the increase of the relaxation rate when a vortex cluster is put in contact with the magnon condensate has been observed. In contrast, the influence of the free liquid surfaces is found to be much weaker. The analysis and interpretation of the results is in progress.
Expected publi-cations and dates:	During this visit Yuriy Bunkov is also working together with Grigori Volovik on two major publication projects, a book chapter and a secondly on a monograph, which both describe the different coherently precessing NMR states and magnon condensation in superfluid 3He. A publication will be prepared which explains the relaxation properties of the very-low-temperature magnon condensates in 3He-B.
Submission date of user group questionnaire:	29 May, 2012

Completed Project Reports should be returned to MICROKELVIN Management Office

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