welcome to the European Microkelvin Collaboration

CAPACITIES

Application Form for MICROKELVIN Transnational Access Project

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:	Title:	Dr.
	First name:	Vladimir
	Last name:	Eltsov
	Home institution:	O.V. Lounasmaa Laboratory, Aalto University
Visiting scientist:	**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:[2]	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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	Curriculum vitae (18 lines max): Professor Bunkov is a senior member of the permanent staff at the Institute of Louis Neél of the Grenoble branch of CNRS, France. He is a widely known expert of 3He superfluids who received the International London Award in 2008 for his pioneering work on magnetic spin transport and coherent spin dynamics in superfluid 3He. He is also well known from his work on rapid non-equilibrium superfluid transitions in 3He, initiated by a thermal neutron capture reaction. His former visit to Aalto University concerned a study of	

1 The lead scientist indicated here is expected to participate in the campaign as a user of the infrastructure.

2 Indicate 'Yes' only if the user has never visited the infrastructure before this specific project, otherwise write 'No'.

	magnon condensates in different rotating states. These studies have since then been continued to explore the spin relaxation of these same rotating states.
	Five most recent publications:
	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. in print
	2 - Yu.M. Bunkov, E.M. Alakshin, R.R. Gazizulin, A.V. Klochkov, V.V. Kuzmin, T.R. Safin, M.S. Tagirov, *Discovery of the Classical Bose–Einstein Condensation of Magnons in Solid Antiferromagnets*, JETP Letters **94**, 68–72 (2011).
	3 - P. Hunger, Yu. M. Bunkov, E. Collin, and H. Godfrin, *Evidence for Magnon BEC in Superfluid ^{3}He-A*, J. of Low Temp. Phys **158**, 129–134 (2010).
	4 - Yuriy M. Bunkov, *^{3}He Experiments: Insights into Cosmology and Atomic Physics*, J. of Low Temp. Phys **158**, 118–128 (2010).
	5 - Yuriy M. Bunkov and Grigoriy Volovik, *Magnon Bose Einstein Condensation and Spin Superfluidity*, J. Phys.: Condens. Matter 22 164210 (2010).
	6 - Yu.M. Bunkov, *Spin superfluidity and magnons Bose–Einstein condensation*, Physics Uspekhi, 53, 843 (2010).

Other participating scientists:[3]	**Name:** Yuriy Bunkov	**Position:** professor	**New User:**[2] No

2. Project Information

Name of host infrastructure:	Low Temperature Laboratory, Aalto University			
Access provider / Infrastructure Director:	**Name:** prof. Matti Krusius		**E-mail address:** mkrusius@neuro.hut.fi	
Planned project dates:	**Start date:**	1.4.2012	**Completion date:**	2.6.2012

Project description (12 lines 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. 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 they should be zero-energy states possessing the Majorana character.

Scientific objectives of the project (12 lines max):

Measurements on the spin relaxation time of magnon condensates in various configurations are currently ongoing at the rotating cryostat and will be continued for the duration of this project. So far a clear result has been obtained for the temperature dependence of the relaxation time associated with the bulk quasiparticles. Also the increase of the relaxation rate when a vortex cluster is put in contact with the magnon condensate has been observed. Measurements with a free surface have just started. The main objective of this project is to develop a model which accurately describes the effect of the bulk quasiparticles on the relaxation time. Then this contribution can be subtracted from the measured dependences. The final goal is to examine the additional relaxation which is caused by zero-energy states and which would reveal the signatures of such Majorana bound fermion states.

Technical description of work to be performed (20 lines max):

The data, which has been collected so far, indicates that the relaxation rate of magnon condensates

3 Please list all participating user group members. Expand the table, if necessary.

depends on the exact profile of the trapping potential. Thus the work will include two stages: First, the trapping potential should be determined. For this the spectroscopy of magnon levels in the trap will be used and the appropriate potential, which produces the same level positions, will be calculated for each of the relaxation measurements. Second, a numerical model of the relaxation, which includes spin diffusion and possibly other relaxation sources, will be developed. The results from the calculations will 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 calculations 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.

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure?	**No**
If yes, please specify:	

Is this proposal submitted to any funding programmes?	**No**
If yes, please specify:	

The completed Application Form should be submitted to MICROKELVIN Management Office (**Sari.Laitila@aalto.fi**, fax +358-9-47022969)