welcome to the European Microkelvin Collaboration

CAPACITIES

Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	**AALTO33**	
Project Title:	**Bose-Einstein condensate of magnons as a probe for vortex structures in 3He-B**	
Lead scientist:[1]	**Title:**	Prof.
	First name:	John
	Last name:	Saunders
Host scientist:[2]	**Home institution:** **Title:**	Royal Holloway, University of London Dr.
	First name:	Vladimir
	Last name:	Eltsov
	Home institution:	Aalto University
Project scientist:[3]	**Title:**	Dr.
	First name:	Lev
	Last name:	Levitin
	Scientific Field: **Home institution:**	Condensed Matter Physics Royal Holloway, University of London
	Is your home institution MICROKELVIN partner?	Yes
	Business address:	Royal Holloway, University of London
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	Curriculum vitae (18 lines max): **Education** **2006-2010**: PhD in Physics, Royal Holloway, University of London, UK. **2000-2006**: BSc and MSc in Physics and Maths, Moscow Institute for Physics and Technology, Russia. **Employment** **2010-present**: Postdoctoral research assistant at Physics Department, Royal Holloway, University of London, UK. **2006-2009**: Teaching assistant (part-time) at Royal Holloway **2003-2006**: Laboratory assistant (part-time) at P. L. Kapitza Institute for Physical Problems, Moscow, Russia. **Scientific Interests** Many-body systems, condensed matter, quantum simulations, unconventional	

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.

	fermionic superfluids and superconductors, low-dimensional systems, strongly correlated systems, tuneable interactions
	Five most recent publications:
	LV Levitin *et al*., *J. Low Temp. Phys.* **158**, 159 (2010)
	RG Bennett *et al*., *J. Low Temp. Phys.* **158**, 163 (2010)
	S Dimov *et al.*, *Rev. Sci. Instr.* **81**, 013907 (2010) JM Parpia *et al.*, *J. Low Temp. Phys.* **150**, 482 (2008)
	LV Levitin *et al.*, *Appl. Phys. Lett.* **91**, 262507 (2007)
Other participating scientists:[4]	**Name:** **Position:** **New User:**
	1-
	2-
	3-

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

2. Project Information

Name of host infrastructure:	**Low Temperature Laboratory, Aalto University**			
Access provider / Infrastructure Director:	**Name: Vladimir Eltsov**		**E-mail address: ve@boojum.hut.fi**	
Planned project dates:	**Start date:**	**[26/05/2013]**	**Completion date:**	**[08/06/2013]**

Project description (12 lines max):

Bose-Einstein condensates of magnon quasiparticles in magneto-textural traps in superfluid 3He-B provide a sensitive probe for the order-parameter texture and relaxation effects at temperatures below 0.3Tc. Their applications to studies of quantized vortex lines and other topological defects in superfluid 3He look especially promising. The goal of this project is to extend such studies to complex vortex structures which include spin-current vortices and to prepare for future more detailed research on the vortex-core-bound fermions.

Scientific objectives of the project (12 lines max):

One objective is to try to create a combined topological defect, a spin-mass vortex, in 3He-B and to cool it for the first time to temperatures below 0.2Tc. There we plan to bring the vortex in contact with the magnon BEC and to study interactions between them. In particular, the soliton tail of the spin-mass vortex presents a potential barrier for the magnons in the condensate. This might provide a possibility to observe Josephson-like effects.

Another objective is to work out a feasible NMR detection scheme for a future experiment on the observation of the minigap spectrum of the vortex-core-bound fermion states. Such a detector should work in a wide range of frequencies, including the range below 100 kHz, which requires use of SQUID-based NMR amplifiers.

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

To create a spin-mass vortex we rotate a cylindrical sample filled with 3He-A at temperatures close to Tc to create A-phase vortices. Then we will rapidly cool the sample, so that the AB interface sweeps through the sample in rotation. This process is known to give spin-mass vortices in a non-equilibrium transition to B phase. Finally we cool the sample in rotation to temperatures below 0.2Tc, apply the magnon trapping potential with magnetic field and create a magnon BEC with continuous-wave or pulsed NMR. We will determine textural part of the trapping potential using spectroscopy of the magnon levels in the trap and will measure its dependence on the number of magnons and relative positions of the magnon condensate and the spin-mass vortex. We will also study relaxation of the magnon BEC and possibly oscillations in the magnon signal related to the Josephson effect.

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)