welcome to the European Microkelvin Collaboration

CAPACITIES

MICROKELVIN Transnational Access Project Report

1. General information

Project number:	CNRS07-1	
Project Title:	Late-time dynamics of quantized vortices generated after absorption of a neutron in superfluid 3He-B	
Lead scientist:[1]	**Title:**	Prof.
	First name:	Andrey
	Last name:	Golov
	Home institution:	Schuster Laboratory, University of Manchester
Host scientist:[2]	**Title:**	Prof.
	First name:	Yuriy
	Last name:	Bunkov
	Home institution:	Institut Neel,CNRS - Grenoble
Project scientist:[3]	**Title:**	Prof.
	First name:	Andrey
	Last name:	Golov
	Birth date:	
	Passport number:	
	Research status/Position:	
	New User:[4]	Yes
	Scientific Field:	
	Home institution:	Schuster Laboratory, University of Manchester
	Is your home institution MICROKELVIN partner?	☐ Yes ☒ No
	Business address:	Schuster Laboratory, University of Manchester
	Street:	Oxford Road
	PO Box:	
	City:	Manchester
	Zip/Postal Code:	M13 9PL
	Country:	**UK**
	Telephone:	+44-161-2754068
	Fax:	+44-161-2754056
	E-mail:	andrei.golov@manchester.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)	The objective is to improve our understanding of the processes occurring after rapid quench-cooling of a small heated bubble of liquid 3He within a bulk superfluid bath at very low temperatures. We propose to conduct a thorough analysis of experimental results on the number of metastable topological defects left behind in superfluid 3He-B after the absorption of one neutron. We elaborate a new ``inflationary'' model that will account for the initial spreading and growth of the vortex tangle (and also the extraction of long-lived individual vortex rings/loops) under the outward wind of thermal excitations immediately following the ``mini Big Bang''. Comparison of the specific predictions of this model with various existing experimental observations should hopefully help to improve the quantitative interpretation of experiments with respect to the efficiency of the Kibble-Zurek mechanism for the generation of topological defects.
Technical description of work performed: (250 words max)	A thorough analysis of the experimental data from the DN1 cryostat of the Microkelvin facility has been performed. The applicability of the "standard" Kibble-Zurek model of the nucleation of topological defects in homogeneous conditions was reviewed. Various assumptions of the model have been critically checked. As a result, several new mechanisms leading to vortex production, multiplication, and conservation were suggested and discussed. Preliminary estimates of the rates and efficiencies of the different mechanisms have been made. These will provide a basis for further analytical and numerical modeling.
Project achievements (and difficulties encountered)**:**[5] (250 words max)	The theoretical model of vortex formation in inhomogeneous temperature conditions is developed. The experimental data is consistent with this model.
Expected publications and dates:	Under preparation "Evolution of neutron-initiated Big-Bang in superfluid 3He-B", by Yu. Bunkov, A. Golov, V. Lvov and Procaccia, planned to be completed by the end of 2012.
Submission date of user group questionnaire:	March 18, 2012

Completed Project Reports should be returned to MICROKELVIN Management Office

(Sari.Laitila@aalto.fi, Fax: +358 9 47022969).