welcome to the European Microkelvin Collaboration

CAPACITIES

MICROKELVIN Transnational Access Project Report

1. General information

Project number:	**CNRS 01**	
Project title:	Late-time dynamics of quantized vortices generated after absorption of a neutron in superfluid 3He-B	
Project acronym:	Minibang	
Lead scientist:[1]	**Title:**	Professor
	First name:	Andrei
	Last name:	GOLOV
	Birth date:	28th January, 1960
	Research status/Position:	*Reader in Low Temperature Physics*
	New User:[2]	No
	Scientific Field:	Low temperature physics
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	Home institution is 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] 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 was to improve our understanding of the processes occurring after a rapid quench of a small bubble of liquid 3He deep into the superfluid phase. We proposed to conduct a thorough analysis of experimental results on the amount of metatstable topological defects left in superfluid 3He-B after absorption of one neutron and to elaborate a new ``inflationary'' model that will account for the initial spreading and growth of the vortex tangle (and also 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 modified model with various existing experimental observations should hopefully help to improve the quantitative interpretation of the experiments in terms of the efficiency of Kibble-Zurek mechanism for generation of topological defects.
Technical description of work performed: (250 words max)	An analysis of the experimental data obtained on the cryostat DN1 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 different mechanisms have been made that will provide a basis for further analytical and numerical modelling.
Project achievements (and difficulties encountered)[5]: (250 words max)	It was concluded that, without rapid spreading of vortices nucleated within the initial hot spot, it is unlikely that their density will survive the time required for the calorimetric measurements. Moreover, alternative inhomogeneous mechanisms of vortex nucleation and multiplication, working in parallel with the Kibble-Zurek mechanism and mainly caused by the counterflow, are expected to be important. It was thus concluded that further analytical and especially numerical modelling is required for better understanding of the processes involved. This analysis will lead to recommendations for the most appropriate conditions for our forthcoming experiments.

Expected publications and dates:	▪ JLTP (2010) ▪ ▪
Submission date of user group questionnaire:	20.08.2009

Completed Project Reports should be returned to MICROKELVIN Management Office (Leena.Meilahti@tkk.fi, Fax: +358 9 4512969).