welcome to the European Microkelvin Collaboration

CAPACITIES

Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	**CNRS17**	
Project Title:	**Late-time dynamics of quantized vortices generated after absorption of a neutron in superfluid 3He-B**	
Lead scientist:[1]	**Title:**	Dr.
	First name:	Anna
	Last name:	Pomyalov
	Home institution:	Weizmann Institute of Science, Rehovot, Israel
Host scientist:[2]	**Title:**	Directeur des recherches
	First name:	Yury
	Last name:	Bunkov
	Home institution:	Institut NEEL
Project scientist:[3]	**Title:**	Dr.
	First name:	Anna
	Last name:	Pomyalov
	Scientific Field:	Turbulence in helium superfluids
	Home institution:	Weizmann Institute of Science, Rehovot, Israel
	Is your home institution MICROKELVIN partner?	No
	New User:	Yes
	Business address:	Weizmann Institute of Science
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	E-mail:	Anna.pomyalov@gmail.com http://www.weizmann.ac.il/chemphys/anna/
	Curriculum vitae (18 lines max): Anna Pomyalov is a senior researcher at the Weizmann Institute and a widely known expert of hydrodynamic theory and numerical simulation in both viscous and superfluid liquids. She joined the Weizmann Institute in 1998.	
	Five most recent publications:	
	1- Laurent Boué, Victor L'vov, Anna Pomyalov, and Itamar Procaccia, Enhancement of Intermittency in Superfluid Turbulence, Phys. Rev. Lett. **110**, 014502 (2013)	
	2-Laurent Boué, Victor L'vov, Anna Pomyalov, and Itamar Procaccia, Energy spectra of superfluid turbulence in ^{3}He, Phys. Rev. B **85**, 104502 (2012)	
	3-Uriel Frisch, Anna Pomyalov, Itamar Procaccia, and Samriddhi Sankar Ray, Turbulence in non-integer dimensions by fractal Fourier decimation. Phys. Rev.	

[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.

	Lett. **108**, 074501 (2012)		
	4-Victor S. L'vov, Anna Pomyalov, Itamar Procaccia, Oleksii Rudenko, Finite-Dimensional Turbulence of Planetary Waves, Phys. Rev E. **80**, 066319 (2009)		
	5-Victor L'vov, Anna Pomyalov, Itamar Procaccia, and Rama Govindarajan, Random Vortex-Street Model for a Self-Similar Plane Turbulent Jet, Phys. Rev. Lett,**101**,094503(2008)		
Other participating scientists:[4]	**Name:**	**Position:**	**New User:**
	Andrey Golov	professor Manchester University, UK	No

2. Project Information

Name of host infrastructure:	MCBT, Institut Neel, Grenoble, France			
Access provider / Infrastructure Director:	**Name: Yury Bunkov / Henri Godfrin**		**E-mail address:** yuriy.bunkov@grenoble.cnrs.fr	
Planned project dates:	**Start date:**	**5/08/2013**	**Completion date:**	**20/08/2013**

Project description (12 lines 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 in superfluid 3He-B after the 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 experiments with respect to the efficiency of the Kibble-Zurek mechanism for the generation of topological defects.

Scientific objectives of the project (12 lines max):

At present there are major unresolved questions concerning the correct interpretation of the different dynamic measurements at the lowest temperatures. Clearly the dynamics should be understood better if we ever want to make use of the helium superfluids as laboratory model systems of coherent quantum matter in the vacuum $T \rightarrow 0$ limit.

Dr. Pomyalov has studied extensively the decay of homogeneous and isotropic superfluid turbulence via the Richardson – Kolmogorov hydrodynamic energy cascade which ultimately at sufficiently low mutual friction dissipation and small length scales (comparable to the inter-vortex distance) couples to Kelvin waves propagating on single vortex lines. It is important to understand how these theories apply to the propagating temperature front when the heated bubble shrinks after the neutron absorption reaction. The new experimental data is expected to provide a better understanding about the consistency between measurement and calculation and hopefully ultimately about the mechanisms which control defect formation in the Kibble-Zurek process.

Technical description of work to be performed (20 lines 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

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

been made that will provide a basis for further analytical and numerical modeling. The main parameters of the dynamical model were established. The final article is ready to 65%. The visit is needed to finish this project and to get the final article to publishable form.

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure?	**Yes**
If yes, please specify:	**Quantum turbulence in the zero temperature limit**

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)