



Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	AALTO28		
Project Title:	Dynamics of quantized vortices in superfluids & superconductors		
Lead scientist: ¹	First name:	Edouard	
	Last name:	Sonin	
	Birth date:		
	Research status/Position:	Prof.	
	New User: ²	No	
	Scientific Field:	Condensed matter physics	
	Home institution:	Racah Institute of Physics, Hebrew University of Jerusalem	
	Home institution is MICROKELVIN partner:	No	
	Business address:		
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	Curriculum vitae (18 lines max):		
	<p>Edouard Sonin is a Professor Emeritus at the Racah Institute of Physics and a widely known expert of hydrodynamic theory in superfluids, superconductors, and magnetically ordered media. He comes originally from the Ioffe Institute in St. Petersburg (Russian Academy of Sciences) from where he moved to the Racah Institute in 1997. He is the author of a widely cited review on superfluid vortex dynamics [1]. His recent review on spin superfluidity [2] was listed as one of the top downloaded articles of Advances in Physics in January 2011.</p>		
References:			
[1] E. B. Sonin, Rev. Mod. Phys. 59 , 87-155 (1987).			
[2] E. B. Sonin, Adv. Phys. . 59 , 181-255 (2010).			
Five most recent publications:			
1. E. B. Sonin and S. K. Nemirovskii, Equilibrium rotation of a vortex bundle terminating on a lateral wall, Phys. Rev. B 84 , 054506 (2011).			
2. E. B. Sonin, Quantum spin Hall effect in 2D topological insulators, in: <i>Spintronic IV</i> , edited by H.-J. M. Drouhin, J.-E. Wegrowe, and M. Razeghi, Proc. of SPIE Vol. 8100 (SPIE, Bellingham, WA, 2011), article 8110003.			

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'.

	3. E. B. Sonin, Dynamics of twisted vortex bundles and laminar propagation of the vortex front, Phys. Rev. B 85 , 024515 (2012).		
	4. E. B. Sonin, Dynamics of helical vortices and helical-vortex rings, Europhys. Lett. 97 , 46002 (2012).		
	5. E. B. Sonin, Symmetry of Kelvin-wave dynamics and the Kelvin-wave cascade in the $T = 0$ limit in superfluid turbulence, Phys. Rev. B 85 , 104516 (2012).		
Other participating scientists: ³	Name:	Position:	New User: ²

2. Project Information

<u>Name of host infrastructure:</u>	Low Temperature Laboratory, Aalto University, Espoo, Finland		
<u>Access provider / Infrastructure Director:</u>	Name: Prof. Matti Krusius Prof. Pertti Hakonen	E-mail address: mkrusius@neuro.hut.fi pjh@boojum.hut.fi	
<u>Planned project dates:</u>	Start date:	2/9/2012	Completion date: 15/9/2012
<u>Project description (12 lines max):</u>			
The project addresses the key problem of today's studies in superfluid turbulence: what is the source of dissipation in the $T=0$ limit, which is observed experimentally, but hardly can be explained by the standard mutual-friction theory. Different scenarios are discussed now (some suggested by Sonin), but the final judgment requires a careful analysis of experimental data, in the light of various theoretical concepts. This makes joint discussions of theorists and experimentalists indispensable.			
<u>Scientific objectives of the project (12 lines max):</u>			
This visit will benefit work in the Microkelvin Joint Research Activities (JRA3 Task 1, where the study of vortex motions in superfluids in the zero-temperature limit is central). Furthermore, discussions during this visit will be helpful to draft parts of the monograph on superfluid vortex dynamics which prof. Sonin is currently working on.			
<u>Technical description of work to be performed (20 lines max):</u>			
During his 2-week visit in the Low Temperature Laboratory, prof. Sonin will get acquainted with the ongoing measurements in the rotating cryostat on vortex dynamics at the lowest temperatures and discuss their physical interpretation (in connection with his paper [3] addressing these experiments). Similarly he will get acquainted with electrical transport measurements on graphene. Finally, he will be discussing with the theorists (Nikolai Kopnin and Grigori Volovik) and the experimentalists (Matti Krusius and Vladimir Eltsov) the importance of the concepts of vortex mass and of vortex forces (in particular, the Kopnin force in the vortex core) in the dynamics of vortices and possible implementation of these concepts to ongoing experiments on low-temperature superfluid turbulence. Further discussions with Risto Hanninen will address numerical simulation calculations of vortex configurations using the vortex filament model with Biot-Savart integration along the line vortices.			

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure?	Yes
Specify:	Vortex dynamics in the zero temperature limit
Is this proposal submitted to any funding programmes?	No
If yes, please specify:	None

The completed application form should be submitted to the [MICROKELVIN Management Office](#)

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