welcome to the European Microkelvin Collaboration

CAPACITIES

Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	**AALTO38**	
Project Title:	**Studies of graphene and superfluid 3He**	
Lead scientist:[1]	**Title:**	Prof.
	First name:	Mikhail
	Last name:	Katsnelson
	Home institution:	Radboud University of Nijmegen
Host scientist:[2]	**Title:**	Dr.
	First name:	Grigory
	Last name:	Volovik
	Home institution:	Aalto University
Project scientist:[3]	**Title:**	professor
	First name:	Mikhail
	Last name:	Katsnelson
	Scientific Field:	physics of strongly correlated systems
	Home institution:	Radboud University of Nijmegen
	Is your home institution MICROKELVIN partner?	no
	Business address:	
	Street:	Heijendaalseweg 135
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	Zip/Postal Code:	6525AJ
	Country:	The Netherlands
	Telephone:	(+31) 24 365 29 95
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	E-mail:	M.Katsnelson@science.ru.nl
	Curriculum vitae (18 lines max): Born 10 August 1957, Magnitogorsk, USSR Married, 2 children; PhD in Solid State Physics at Institute of Metal Physics (Sverdlovsk), 1980; Professorship in Solid State Physics and in Mathematical Physics in Ural State University, 1992; in Theoretical Physics in Radbound University of Nijmegen 2004. Knight of the Order of the Dutch Lion, 2011; Honorary Doctor of Uppsala University, 2012 **Present position:** professor, head of the group of Theory of Condensed Matter, Radboud University of Nijmegen, The Netherlands. **Publications:** 517 published papers, including: REV MOD PHYS - 1, PHYS REP - 1, SCIENCE - 7, NATURE - 3, NATURE MAT - 2, NATURE PHYS - 6, PNAS - 2, NANO LETT - 6, PHYS REV LETT - 43	
	Five most recent publications:	
	1- K. Glazyrin, L. V. Pourovskii, L. Dubrovinsky, O. Narygina, C. McCammon, B. Hewener, V. Schuenemann, J. Wolny, K. Muffler, A. I. Chumakov, W. Crichton, M. Hanfland, V. Prakapenka, F. Tasnadi, M. Ekholm, M. Aichhorn, V. Vildosola, A. V.	

[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.

	Ruban, M. I. Katsnelson, and I. A. Abrikosov, Importance of correlation effects in hcp iron revealed by a pressure-induced electronic topological transition PHYS REV LETT 110, 117206 (2013)		
	2-Y. Jiang, T. Low, K. Chang, M. I. Katsnelson, and F. Guinea, Generation of pure bulk valley current in graphene PHYS REV LETT 110, 046601 (2013)		
	3-M. I. Katsnelson, G. E. Volovik, and M.A. Zubkov, Euler - Heisenberg effective action and magnetoelectric effect in multilayer graphene ANN PHYS (NY) 331, 160 (2013)		
	4- A. B. Shick, J. Kolorenc, J. Rusz, P. M. Oppeneer, A. I. Lichtenstein, M. I. Katsnelson, and R. Caciuffo, Unified character of correlation effects in unconventional Pu-based superconductors and delta-Pu PHYS REV B 87, 020505(R) (2013)		
	5- S. Yuan, R. Roldan, A.-P. Jauho, and M. I. Katsnelson, Electronic properties of disordered graphene antidot lattices PHYS REV B 87, 085430 (2013)		
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: Matti Krusius**		**E-mail address: Matti.Krusius@aalto.fi**	
Planned project dates:	**Start date:**	**11/08/2013**	**Completion date:**	**17/08/2013**

Project description (12 lines max):

The project is devoted to studing the common properties of superfluid 3He and graphene, and to the planning of experiments with graphene in the superfluid 3He environment. Both systems are topological materials. They contain topologically protected massless fermions : 2+1 Dirac fermions in graphene ; 3+1 Weyl fermions in bulk 3He-A ; 2+1 Majorana fermions on the surface of 3He-B ; 1+1 Majorana fermions in the cores of quantized vortices. In both systems relativistic quantum fields and gravity emerge with all the related phenomena, such as chiral anomaly, Hawking-Unruh effects and Schwinger pair production in electric field. The combination of graphene and superfluid 3He will allow to study the interplay of the properties of two topological materials, and new effects, which emerge, when these materials are combined,

Scientific objectives of the project (12 lines max):

Experiments on graphene immersed in superfluid 3He may include: experiment on the spin Josephson effect in 3He-B due to spin current through the graphene layer; exploiting oscillating graphene for observation of Majorana fermions on the graphene boundary of 3He-B; investigation of properties of graphene in the superfluid environment at ultralow temperatures under different conditions (in the presence of rotation, superflow, quantized vortices, external magnetic field, magnon Bose-Einstein condensate, etc.).

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

We shall discuss the common properties of graphene and the superfluid phases of 3He and the interplay of these two topological materials. We shall also plan the experiments on graphene immersed in superfluid 3He which elucidate the new phenomena.

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure?	**Yes**
If yes, please specify:	**AALTO37**

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)