welcome to the European Microkelvin Collaboration

CAPACITIES

Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	**AALTO06**	
Project Title:	**CROSS CORRELATIONS IN GRAPHENE**	
Project accronym	**CCG**	
Lead scientist:[1]	Title:	**Dr.**
	First name:	**Maciej**
	Last name:	**Wiesner**
	Birth date:	**06.06.1965**
	Passport number:	**AS 7647389**
	Research status/Position:	**Senior Scientist**
	New User:[2]	**No**
	Scientific Field:	**Physics of mesoscopic materials, solid state physics**
	Home institution:	**Adam Mickiewicz University, Faculty of Physics**
	Is your home institution MICROKELVIN partner?	**No**
	Business address:	**Adam Mickiewicz University, Faculty of Physics**
	Street:	**Umultowska 85**
	PO Box:	
	City:	**Poznań**
	Zip/Postal Code:	**61-614**
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	Telephone:	**+48 61 8295192 mobile: +48 696 242 792**
	Fax:	
	E-mail:	**mwiesner@amu.edu.pl**
	Curriculum vitae (18 lines max): 1989 - MSc thesis „ Neutron investigation of molecular dynamics and structure in d-camphore crystals"; 1995 - PhD thesis „ Dielectric relaxation in $Cd_2Nb_2O_7$ single crystals in temperature range 4.7 K - 300 K".; 1995- Senior scientist, Dept. of Crystals Physics, Adam Mickiewicz University. ACADEMIC VISITS ABROAD: 1989-1991 Joint Institute for Nuclear Research (JINR), Dubna USSR 3 visits, 3 mo 1995 Rutherford Appleton Laboratory, UK -10 days. 1998 NATO ASI - SUSSP51 School in Muon Science 15.11.2007–15.8.2008 LTL, Helsinki University of Technology 2009 - LTL, Helsinki University of Technology - 3 months RESEARCH AND EXPERIENCE: 1. Shot noise and conductivity measurements in graphene. 2. Cryogenic engineering. 3. Manufacturing and characterisation of graphene samples. 4. Low noise measurements of transport properties of ferroic crystals. 5. Low temperature measurements of dielectric properties of crystals 6. Acoustic phonon coupling to charge density waves. 7. High resolution measurements of capacitance of ferroic materials 8. Inelastic neutron scattering, Dynamic Mechanical Analysis, Differential Scanning Calorimetry, Differential Thermal Analysis, 9. Glassy and relaxor state, incommensurate phase transition	

[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'.

	10.Design and construction of experimental setups.		
	Five most recent publications:		
	1-M. Wiesner, *Phase Transitions* 82, no. 10, 699, 2009		
	2-M.Kaczmarski, M. Wiesner, *J. of Raman Spectr*. DOI 10.1002/jrs.2603		
	3- M. Wiesner, B. Mróz, *Ferroelectrics*, 363, 134, (2008)		
	4- A. Fay, J.K. Viljas, R. Danneau, F. Wu, M.Y. Tomi, J. Wengler, M. Wiesner, and P.J. Hakonen, arXiv:0904.4446v1 [cond-mat.mes-hall].		
	5- H. Alles, J. Aarik, A. Aidla, A. Fay, J. Kapšai, A. Niilisk, M. Pärs, M. Rähn, M. Wiesner, P. Hakonen, and V. Sammelselg, *Atomic layer deposition of HfO_2 on graphene from $HfCl_4$ and H_2O* to be published.		
Other participating scientists:[3]	Name:	Position:	New User:[2]
	1-		

2. Project Information

Name of host infrastructure:	Low Temperature Laboratory, Helsinki University of Technology			
Access provider / Infrastructure Director:	Name:		E-mail address:	
	Professor Pertti Hakonen,		pjh@boojum.hut.fi	
Planned project dates:	Start date:	[15/03/2010]	Completion date:	15/06/2010

Project description (12 lines max):
This project is aimed to investigate cross correlation of a current in graphene sheet. One of the most informative parameters, revealing quantum properties of a current in mesoscopic samples, is the shot noise (current fluctuations). The current fluctuations are characterized by 2nd order and higher moments of their probability distribution P. Experimentally, the mean of P is obtained by time averaging, i.e. by dc current. The second moment (the variance) of P, measures the amplitude of the current fluctuations. The third moment (the skewness) measures the asymmetry of the fluctuations. The existence of the third moment is related to the breaking of time reversal symmetry by the dc current; at zero bias, and positive and negative current fluctuations are equivalent, so the third moment is equal zero. Microwave signals will be used to calculate cross-correlation functions which are averaged to improve signal-to-noise ratio. Values of a normalized cross-correlation function can vary between ±1. Usually one can relate the negative current-current correlation to charge carriers obeying the Pauli exclusion principle (fermions), whereas positive cross-correlation is attributed to bosons. However, two entangled electrons, forming a Cooper pair in the superconductor (the injecting contact), are emitted into different exit leads due to Coulomb repulsion, giving rise to positive cross-correlation. There are experiments showing successful Cooper pair splitting using a quantum wire divided into two quantum dots. Construction of the splitter using a monolayer graphene sheet is the main task of the project. To make an effective Cooper pair injector, the optimization of the transmissivity of the injecting contacts is of vital importance. With optimized Cooper pair splitter the cross-correlation measurement will be carried out at milliKelvin temperatures in Otaniemi.

Scientific objectives of the project (12 lines max):
The cognitive aspects of the project:

1. construction of the Cooper pair beam splitter,
2. calculation of moments of the current fluctuation,
3. measurements of the cross-correlation on the monolayer graphene,

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

1. preparation and characterisation of monolayer samples,
2. optimization of the injecting and collecting contacts (material which they are made of, their size and distance between them),
3. preparation of the Cooper pair splitter using a monolayer graphene sheet,
4. an analysis of results of the measurements.

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure?	No

Is this proposal submitted to any funding programmes?	No

The completed Application Form should be submitted to MICROKELVIN Management Office (Katariina.Toivonen@neuro.hut.fi, fax +358-9-47022969)

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