



Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	CNRS02	
Project title:	Dynamic structure factor of 2D liquid ³He beyond the particle hole band	
Project acronym:	HighQ	
Lead scientist: ¹	Title:	Professor
	First name:	Eckhard
	Last name:	Krotscheck
	Birth date:	July 30, 1944
	Passport number:	P2318633
	Research status/Position:	Professor
	New User: ²	Yes
	Scientific Field:	Quantum Fluids, microscopic many-body theories, analysis of neutron data
	Home institution:	University of Linz
	Is your home institution MICROKELVIN partner?	No
	Business address:	Institute for Theoretical Physics
	Street:	Altenbergerstr. 69
	PO Box:	
	City:	Linz
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	Telephone:	(+43) 732 / 2468-8544
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	E-mail:	eckhard.krotscheck@jku.at
	Curriculum vitae (18 lines max):	
	<ul style="list-style-type: none"> • Diploma, Theoretische Physik, Universität Köln 1971 • Ph.D., Theoretische Physik, Universität Köln 1974 • Habilitation, Theoretische Physik, Universität Hamburg 1979 • Heisenberg Fellow, 1980-1984 • Associate Professor and Professor, Texas A&M University, 1984-1995 • Professor Universität Linz, since 1995. • APS Fellow 1996 • Feenberg Medal 2007 	
	Five most recent publications:	
	1- E. Krotscheck and M.D. Miller , "Third sound and stability of thin ³ He ⁴ He films", Phys. Rev. B 73, 134514, (2006)	
	2- J. Boronat, J. Casulleras, V. Grau, E. Krotscheck, and A. Springer , "Effective mass of two-dimensional ³ He", Phys. Rev. Lett. 91, 085302, (2003),	

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- A. Fabricini, S. Fantoni, and E. Krotscheck (Editors) <i>"Introduction to Modern Methods of Quantum many Body Theory and their Applications"</i> , Series on Advances in Quantum Many-Body Theory Vol.7, World Scientific, Singapore (2002)		
	4- E. Krotscheck and R. E. Zillich "Hydrogen and ^3He Atoms on ^4He Surfaces: Bound states and scattering features", Phys. Rev. B 77, 094507 (2008).		
	5- C. E. Campbell and E. Krotscheck "Dynamic Many-Body Theory. I. Pair fluctuations in bulk ^4He , Phys. Rev. B (in press, 2009).		
Other participating scientists: ³	Name:	Position:	New User: ²
	1- Martin Panholzer	PhD student	Yes
	2- Robert Holler	PhD student	Yes
	3- Jakob Egger	Master student	Yes

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

2. Project Information

Name of host infrastructure:	Institut Néel, CNRS, Grenoble (MICROKELVIN-Grenoble)		
Access provider / Infrastructure Director:	Name: H. Godfrin	E-mail address: henri.godfrin@grenoble.cnrs.fr	
Planned project dates:	Start date:	09/11/2009	Completion date: 25/11/2009
Project description (12 lines max):			
<p>We have recently shown that two-dimensional ^3He, a simple 2D Fermi liquid, displays a well defined collective mode at high wave-vectors (1). The observed density excitation is similar to the phonon-roton mode well known in ^4He. This striking effect is well beyond the scope of Landau's theory of Fermi Liquids. It has been successfully described by the many-body "two-particle two-hole" theory developed by the Linz theory group(2).</p> <p>It is highly desirable to explore the dynamics of the system at elevated wave-vectors, to follow the newly discovered dispersion relation branch at high energies. The theory can indeed predict this behaviour, but present experimental data cover a limited region in the wave-vector (k)-energy ($\hbar\omega$) plane.</p> <p>1) <i>Observation of zero-sound at atomic wave-vectors in a monolayer of liquid ^3He</i> H. Godfrin, M. Meschke, H.-J. Lauter, H.M. Böhm, E. Krotscheck, M. Panholzer QFS2009 - J. of Low temp. Phys. (August 2009)</p> <p>2) <i>Two-Dimensional ^3He: A Crucial System for Understanding Fermion Dynamics</i> H.M. Böhm, E. Krotscheck, M. Panholzer, H. Godfrin, H. J. Lauter, M. Meschke QFS2009 - J. of Low temp. Phys. (August 2009)</p>			
Scientific objectives of the project (12 lines max):			
<ul style="list-style-type: none">- Determination of the high wave-vector / Energy sector of the dynamic structure function $S(q,\omega)$ of 2D liquid ^3He films at low temperatures (below 100 mK).- Study of the high wave-vector dispersion of the zero sound mode beyond the particle-hole continuum.- Understand the behaviour of a Fermi liquid dynamics beyond Landau's theory in the framework of a novel many-body approach.			
Technical description of work to be performed (20 lines max):			
<ul style="list-style-type: none">- Neutron scattering measurements at a neutron wavelength of 0.51 nm were used in our former experiments for the initial determination of the dynamic structure factor $S(q,\omega)$ of liquid ^3He films of atomic thickness. In order to reach higher values of k and ω, a new series of experiments will be performed at a much shorter neutron wavelength, 0.41 nm. This increases the range in the (k, ω) plane adequately (at the expense of a somewhat poorer resolution). The neutron part of the experiment is already scheduled at the ILL (November 12-17, 2009)- ^3He films are formed by physical adsorption of ^3He gas on exfoliated graphite. Adsorption isotherms will be performed to determine the helium film areal density. In addition, neutron diffraction will be used on the solid ^4He preplating layer to check the area calibration.- The experimental cell is designed for these studies, and has been used in previous experiments. The substrate consists of ZYX exfoliated graphite of high quality, characterised by a large coherence length.- A dilution refrigerator of the Microkelvin Facility TA2 (CNRS-Grenoble) specially designed for neutron scattering, or a smaller refrigerator of the ILL cryogenic service, can be used for this experiment. The installation of the sample and its characterization will be done by the Microkelvin group prior to the ILL measurements.- The neutron measurements and the data acquisition will be made by M. Panholzer (Univ. of Linz), H.J. Lauter and H. Shober (ILL local contacts), and the Microkelvin local contacts (H. Godfrin, A. Sultan).- The analysis of the raw data involves heavy computational tasks, they will be the responsibility of M. Panholzer and A. Sultan.- The theoretical analysis will be done by E. Krotscheck, H. Böhm, and M. Panholzer.-The stay of M. Panholzer in Grenoble is foreseen between November 9th and 25th, and a second visit of one week may be needed to finalise the data analysis.			

3. Joint Proposals / Funding

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

If yes, please specify:

Is this proposal submitted to any funding programmes? Yes No

The Austrian FWF has already provided support to the theoretical work, and an international ANR/FWF proposal has been submitted by CNRS and the University of Linz. This proposal, if accepted, would allow improving further the Grenoble-Microkelvin facility and facilitate theoretical developments in Linz on this subject. Note that these costs are not covered by Microkelvin.

The completed Application Form should be submitted to MICROKELVIN Management Office
(leena.meilahti@tkk.fi, fax +358-9-4512969)