welcome to the European Microkelvin Collaboration

Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	**CNRS18**	
Project Title:	**Investigation of 2D and 3D frustrated magnets in the mK regime**	
Lead scientist:[1]	**Title:**	Dr
	First name:	Romain
	Last name:	SIBILLE
	Home institution:	Paul Scherrer Institut
Host scientist:[2]	**Title:**	Dr
	First name:	Elsa
	Last name:	Lhotel
	Home institution:	CNRS, Institut Néel, Grenoble
Project scientist:[3]	**Title:**	Dr.
	First name:	Romain
	Last name:	SIBILLE
	Scientific Field:	Condensed Matter Physics
	Home institution:	Paul Scherrer Institut
	Is your home institution MICROKELVIN partner?	No
	Business address:	Laboratory for Developments and Methods
	Street:	WLGA/027
	PO Box:	
	City:	VILLIGEN
	Zip/Postal Code:	5232
	Country:	SWITZERLAND
	Telephone:	+41 56 310 35
	Fax:	
	E-mail:	romain.sibille@psi.ch
	Curriculum vitae (18 lines max): **- 01.11.2012 –** : Postdoctoral researcher at Paul Scherrer Institut (LDM), under supervision of Dr. Michel Kenzelmann: *'Preparation and realization of scattering experiments on multiferroics, superconductors and magnetically frustrated systems'* **- 01.10.2009 – 30.09.2012** : Ph.D. in Solid State Chemistry at Institut Jean Lamour (Nancy, France), under supervision of Pr. Michel Francois: '*Organic – Inorganic hybrid solids based on dicarboxylic molecules and 3d or 4f elements: structure – magnetic properties relations, dimensionality effects'* **- 09/2007** – **06/2009** : Master in Materials Sciences 'Molecules, Materials, Surfaces' at Université Paris Diderot (France), *obtained with highest honours, 1st rank.* 5th year semester project at ITODYS (Université Paris Diderot) under supervision of Pr. Jean-Christophe Lacroix: '*Conducting oligomers – single molecule magnet systems: towards electro-switchable molecular magnetism'* **- 09/2004** – **06/2007** : Bachelor in Materials Sciences 'Chemistry and Physical Chemistry' at Nancy University (France), *obtained with honours*	

[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.

	Five most recent publications:		
	1- **Ab-Initio XRPD Crystal Structure and Magnetic Properties of $Mn_3(OH)_2(C_6H_2O_4S)_2$ Metal-Organic Framework** *R. Sibille, T. Mazet, B. Malaman, E. Elkaïm and M. François* *Inorganic Chemistry*, **DOI:** 10.1021/ic301423c, **2013**		
	2- **A Metal-Organic Framework as Attractive Cryogenic Magnetorefrigerant** *R. Sibille, T. Mazet, B. Malaman and M. François* *Chemistry – A European Journal*, **2012** (18) 12970-12973		
	3- **Magnetic measurements and neutron diffraction study of the layered hybrid compounds $Mn(C_8H_4O_4)(H_2O)_2$ and $Mn_2(OH)_2(C_8H_4O_4)$** *R. Sibille, A. Mesbah, T. Mazet, B. Malaman and M. François* *Journal of Solid State Chemistry*, **2012** (186) 134-141		
	4- **$Co_4(OH)_2(C_{10}H_{16}O_4)_3$ Metal-Organic Framework: Slow Magnetic Relaxation in the Ordered Phase of Magnetic Chains** *R. Sibille, T. Mazet, B. Malaman, T. Gaudisson and M. François* *Inorganic Chemistry*, **2012** (51) 2885-2892		
	5- **Magnetism in the $(Co_{1-x}Fe_x)_2(OH)_2(C_8H_4O_4)$ solid solutions: a combined neutron diffraction and magnetic measurements study** *A. Mesbah, R. Sibille, T. Mazet, B. Malaman, S. Lebègue and M. François* *Journal of Materials Chemistry*, **2010** (20) 9386-9391		
Other participating scientists:[4]	**Name:**	**Position:**	**New User:**
	1- Dr. Michel Kenzelmann	Head of Laboratory for Developments and Methods at Paul Scherrer Institut	Yes

NOTE: **We kindly ask for financial support for the second participating scientist, Dr. Michel Kenzelmann, from 04.06.2013 to 07.06.2013.**

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

2. Project Information

Name of host infrastructure:	**Microkelvin TA2 Facility – CNRS Grenoble**			
Access provider / Infrastructure Director:	**Name: Henri GODFRIN**		**E-mail address: henri.godfrin@grenoble.cnrs.fr**	
Planned project dates:	**Start date:**	**27.05.2013**	**Completion date:**	**17.06.2013**

Project description: Investigation of 2D or 3D frustrated magnets in the mK regime

The aim of this project is an experimental investigation of highly frustrated magnetic systems in two or three dimensions by means of macroscopic magnetization and AC susceptibility measurements in the mK temperature range, which is available at CNRS-Grenoble.

First, we will investigate a family of cerium-based pyrochlore insulators with the general formula $Ce^{III}_2B_2O_7$ with B = Zr, Sn, Hf. The magnetic moments lie on a 3D lattice of corner-sharing tetrahedra leading to geometrical frustration. In these systems the natural tendency to form long-range ordered ground states is frustrated, resulting in novel short-range ordered alternatives such as spin glasses, spin ices and spin liquids. The interest in the cerium-based materials is their small magnetic moment, which reduces the strength of the classical dipolar interactions and provides an interesting playground to study quantum phenomena.

Secondly, we will focus on the $Co^{II}_5(OH)_2(C_4H_4O_4)_4$ metal-organic framework in which the 2D geometrically frustrated lattice of magnetic ions has a different topology compared to the most often studied Kagome, triangular and star lattices. The questions of long-range order (estimated to be around 1.5 K from an epithermal neutron diffraction study) and of the dynamical properties in the ordered state will be addressed.

Scientific objectives of the project:

- $Ce^{III}_2B_2O_7$ compounds: the main objective of the proposed experiments is to provide a description of the macroscopic behaviour of these materials in the temperature range below 2 K. This will be, by itself, the first experiment to understand the nature of their magnetic properties, and also an essential and solid background for the realization of further experimental investigations (mainly based on neutron scattering techniques). The general objective of the study of this family of compounds is the observation of experimental signatures of quantum spin-ice.

- $Co^{II}_5(OH)_2(C_4H_4O_4)_4$ metal-organic framework: the main goal is to investigate the magnetic properties driven by this uncommon type of geometrically frustrated lattice in the case of Co^{II} spins. We will be able to determine the temperature and the nature of the magnetic ordering transition as well as the evolution of the magnetic properties around the transition. This will provide information original about the magnetic fluctuations. Our results will be supplemented with a study of the magnetic structure, by means of neutron diffraction experiments at very low temperatures at the Paul Scherrer Institut.

Technical description of work to be performed:

- In the case of the pyrochlore compounds $Ce^{III}_2B_2O_7$ the realization of macroscopic measurements in the mK regime is an essential step towards further investigations of their magnetic state. Thus, the first work will be to determine if these compounds order in the range of temperatures reachable with dilution cryostats. Once this question is answered, and whatever the nature of the answer, measurements will be realized in more details with both DC and AC techniques, in various applied magnetic fields, and also as a function of the orientation of the crystallographic axes relative to the direction of the magnetic field.

- For the $Co^{II}_5(OH)_2(C_4H_4O_4)_4$ metal-organic framework, we will take a large advantage from the two SQUID magnetometers installed at the Institut Néel in order to perform the detailed study of this compound. Measurements will be realized in the temperature range 0.1 K – 2 K with both DC and AC techniques. SQUID detection will be of prime importance for the measurement of the relatively small single-crystals that can be obtained for this compound, with the aim of characterizing the magnetic anisotropy of the system. Furthermore, the isostructural compound based on Fe^{II} spins has shown remarkable dynamic properties in the ordered state (*R.Sibille, Ph.D Thesis, 2012*); similar behaviour might be expected for the Co^{II} compound and the exceptional possibilities offered by one of the instruments in terms of AC magnetic measurements (down to very low frequencies) will be central to our studies.

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure?	**No**
If yes, please specify:	

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)