

Workshop of the " Highly Frustrated Magnetism" ESF program

Report

Materials for Frustrated Magnetism

3-5 March 2008, Grenoble, France



ESF workshop on

MATERIALS FOR FRUSTRATED MAGNETISM

Grenoble 3-5 march 2008

Invited Speakers :

J.P. Attfield (Edinburgh)
B. Bartlett (Berkeley)
G. Collin (Orsay)
L. Cronin (Glasgow)
R. Dronskowski (Aachen)
M. Fourmigué (Rennes)
C. Geibel (Dresden)
J. Greedan (McMaster)
M. Johansson (Stockholm)
H. Kageyama (Kyoto)

<http://mffm.neel.cnrs.fr>



MATERIALS FOR
FRUSTRATED MAGNETISM

Introduction

The ESF-funded program on highly frustrated magnetism (HFM) is proving very effective, with a wide range of subjects covered by well-attended meetings over the past 3 years. One of these meetings, a workshop on HFM Materials, held in Stockholm on 12-14th June 2006, focussed on materials aspects of frustrated magnetic materials, ranging from principles of design of new systems, to methods of synthesis. This event attracted considerable interest, but it could only take of the order of 25 participants. There was clearly much greater unsatisfied demand, so we proposed to organise a meeting in a similar area for a larger number of people. The MFFM workshop held in Grenoble 3-5 March 2008 is the result of this process.

The organizing committee of the workshop was composed of :

Claude Berthier (Grenoble High Magnetic Field Laboratory)

Pierre Bordet (Institut Neel, CNRS)

Andrew Harrison (Institut Laue-Langevin)

Claudine Lacroix (Institut Neel, CNRS)

Pascal Lejay (Institut Neel, CNRS)

Workshop secretaries :

Alison Mader (Institut Laue-Langevin)

Laurence Tellier (Institut Laue-Langevin)

Webmaster :

Bernard Maire-Amiot (Institut Neel, CNRS)

Practical Aspects

The workshop was organized at the Institut Laue-Langevin neutron high flux reactor in Grenoble. The organization greatly benefited from the on-site availability of the ILL-ESRF restaurant and guest house, which were offered free for participants. Rooms at the guest house were reserved preferentially to students and postdocs, but all demands could be satisfied. The workshop registration was free for all participants (including the workshop banquet). Invited speakers were reimbursed for their transportation and hotel costs. The oral sessions took place at the ILL Chadwick conference room and the poster sessions at the joint ILL-ESRF library. The workshop banquet held at the Restaurant du Téléphérique, on top of the Bastille hill overlooking Grenoble, was enjoyed by 75 participants.

Budget

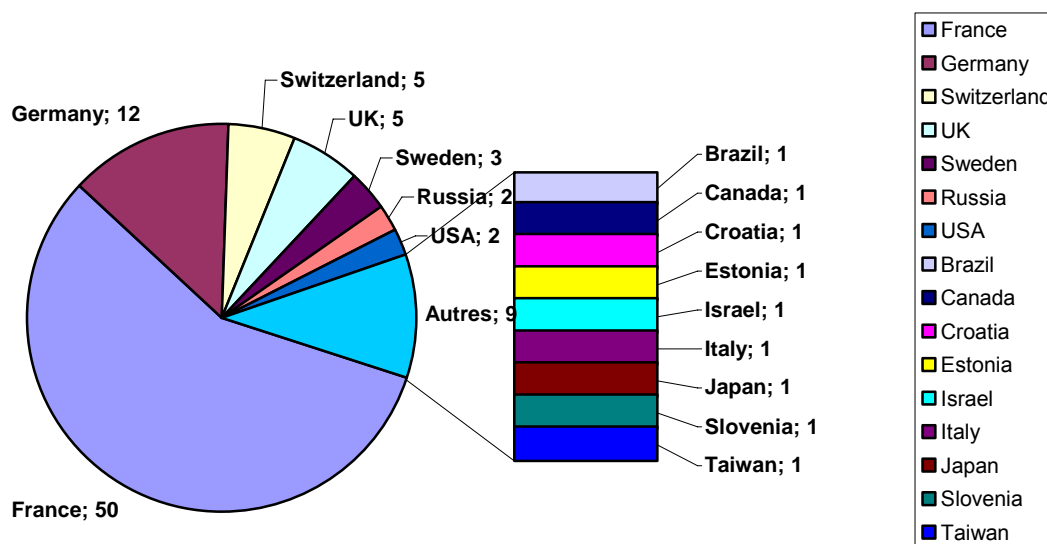
Based on the provisional budget the ESF dotation for the workshop was 20 k€ of which 80% (16 k€) were transferred to the organizers. This covered the registration of all participants, and the travel and lodging expenses of all invited speakers. Other participants benefited from the ILL guest house. The midday meals were taken at the ILL canteen. Other expenses were essentially used for the coffee breaks and banquet. The detail of the budget is presented in the table below. The ILL also contributed financially through a dotation for the workshop organization. The budget is well equilibrated with the 16 k€ already allocated by the ESF and a further transfer of the remaining funds is not required.

object	Expenses (€)	Income (€)
ILL Guest house	1 138.78	
Travel invited speakers	5 911.00	
Hotel invited speakers	2 689.20	
ILL cantine	1 956.37	
Coffee breaks	1 257.84	
Banquet	3 443.50	
ESF Dotation		16 000.00
ILL Dotation		396.69
Total	16 396.69	16 396.69

Participants

88 registered scientists took part in this workshop, including 24 students and postdocs. Due to the conference location on the ILL-ESRF site, the conferences were also eventually attended by a noticeable number of users of these facilities and local students/postdocs. The graph below summarizes the origin of participants, who came from 10 different European countries (90% of registered participants) and 6 extra-european countries.

Origin of Participants



As we expected, the attendance was far from being limited to specialists of the material aspects of HFM and also comprised a large proportions of experimental physicists and theoreticians. The number and variety of participants appeared to be very convenient for close

scientific contacts and discussions between scientists of different backgrounds, which was one of our main goals. The full list of participants is given at the end of this report.

ScientificContent

The principal aim of the MFFM meeting was to bring together chemists and materials scientists with expertise in a range of methods of synthesis and materials preparation, with physicists who would more commonly perform detailed magnetic measurements, and to a large extent define what is needed of model compounds. Therefore, we built the workshop program with in mind the need for a pedagogical presentation of materials aspects to physicists, and HFM requirements to chemists, including the possibility to have easy, informal discussions between participants.

The workshop was organized around sessions devoted to specific type of HFM-related materials : triangular systems, cobaltates, kagome, intermetallics, pyrochlores, etc...). It was divided in nine sessions, with ten 40' invited lectures and twenty one 20' contributed talks. Each session was opened by an introductory conference given by an invited speaker expert in the materials aspects of the corresponding systems, followed by talks on recent developments in the field.

The pdf version of most of these presentations are available from the MFFM web site : <http://mffm.neel.cnrs.fr/>

Two poster sessions (1:30 each) took place in the afternoon of the first and second day of the workshop, before the afternoon oral sessions. The posters were kept visible during the two sessions, which took place at the ILL library, and were excellent opportunities for meetings and discussions among the participants while enjoying coffee and cakes.

Session I

The workshop opened by an introductory presentation of A. Harrison (director of the ILL and co-convenor of the workshop), followed by the two invited lectures by John Greedan (McMaster) and J.P. Attfield (Edinburgh). These talks provided an excellent overview of the state of the art in materials chemistry for magnetism and magnetic frustrated systems.

Session II

Session II was devoted to one dimensional triangular spin systems, starting with the presentation of L. Cronin (Glasgow) on recently discovered spin tubes. It was followed by S. Zvyagin (Dresden) who spoke of ESR measurements of spin chains and G. Nilsen (Edinburgh) who presented the new system of spin $\frac{1}{2}$ frustrated chain antiferromagnet: $\text{KTi}(\text{SO}_4)_2 \cdot (\text{H}_2\text{O})$.

Session III

After the first poster session, this session was devoted to the cobaltate systems. It started by an introductory invited presentation by G. Collin (Orsay), who gave an overview of the crystal-chemistry of the Na_xCoO_2 system. It was followed by four contributed talks (M.B. Lepetit, A. Vasiliev, T. R  m, N.B. Christensen) reporting on various related issues from quantum chemical to diffuse scattering measurements.

Session IV

Opening the second day of the workshop, this session was devoted to kagome systems. The invited talk was given by B. Bartlett (Berkeley) who gave an overview of the magnetic frustration in synthetic jarosites. B. Fak presented results of inelastic neutron scattering on a similar system, while Ph. Mendels proposed μ Sr data on the recent “perfect” kagome antiferromagnet of the paratacamite family.

Session V

This session started with the invited presentation by C. Geibel (Dresden), who gave an overview of magnetic frustration in intermetallic compounds. R.Dronskowski continued with the crystal-chemistry of such systems with an emphasis on nitrides. The session was closed by the talk of P. Deen who demonstrated the possibilities of neutron polarisation analysis with the renewed D7 instrument.

Session VI

This session essentially concerned magnetic properties of molecular based materials, with an introductory talk by M. Fourmigué (Rennes) followed by H. Yan and M. Kenzelmann. Y. Chapis close the second day of the workshop by presented spin dynamics studies in 3D frustrated systems.

Session VII & VIII

These two sessions were devoted to various types of recently discovered low dimensional frustrated systems, with emphasis on the materials aspects. In his invited lecture, H.Kageyama (Kyoto) reported on the low temperature synthesis of 2D, O-depleted Fe perovskites, while M. Johnsson (Stockholm) presented chemist strategies for preparing new 2D compounds. Contributed talks were given by M. Zayed, P. Lemmens, V. Simoney and R. Klingeler, each reporting on a different class of new 2D frustrated magnets.

Session IX

The final session was focused on pyrochlore frustrated systems. It comprised six contributed talks on various aspects of these materials, from chemistry and crystal growth (P. Strobel, A.-A. Haghighirad, S. Singh) to physical and neutron scattering measurements (R. Kremer, J. Gardner and S. Bramwell).

We hope to have met the expectations of the participants and HFM community in building an equilibrated program from which each one could benefit, bringing together researchers of different “cultures” to learn and exchange about this fascinating topic of magnetic frustration. The large attendance of the workshop was beyond our expectation, and was even greater due to the presence of numerous “passing by” local scientists, students and postdocs. The lively general atmosphere of scientific exchange during the workshop and the comments of the participants at the end let us think that the workshop was an overall success.

Materials for Frustrated Magnetism

PROGRAMME

All talks will take place in the ILL – Chadwick Amphitheatre

Monday 3rd March

8h30 Registration

Session 1

9h20 A. Harrison Welcome and opening
9h30 J. Greedan Design and characterization of geometrically frustrated and low dimensional magnetic materials with ordered perovskite and ordered rock salt structures
10h10 J. P. Attfield Exploring Magnetism in Transition Metal Oxides

10h50 Coffee

Session 2

11h20 L. Cronin Triangular Spin Tubes: Design, Synthesis and Magnetic Properties
12h00 S. Zvyagin ESR excitations in the BEC candidate DTN: what can we learn from that?
12h20 G. Nilsen A New Realisation of the $S=1/2$ Frustrated Chain Antiferromagnet

12h40 Lunch

14h00 Poster session at ILL19/20

15h00 Coffee

Session 3

16h30 G. Collin Some problems of materials in sodium cobaltates : a possible structural model and eventual magnetic consequences
17h10 M.-B. Lepetit Quantum chemical calculations on the CoO₂ based materials
17h30 A. Vasiliev Low dimensional magnetic systems: various routes to quantum ground state S
17h50 T. Rõõm Spin waves in multiferroic LiCu₂O₂: far-infrared study in magnetic field
18h10 N.B Christensen Diffuse scattering in Co₃O₄ and Co(Al_{1.3}Co_{0.7})O₄ studied by neutron diffraction and spectroscopy. An indication of a spiral spin liquid phase?

Tuesday 4th March

Session 4

- 9h00 B. Bartlett Spin Frustration in the Paradigmatic Kagomé Lattice: A Problem for Synthetic Inorganic Chemistry
9h40 B. Fåk Spin-liquid behavior in a classical Heisenberg kagomé antiferromagnet
10h00 Ph. Mendels Magnetization, ¹⁷O NMR and μ SR studies of the paratacamite family

10h20 Coffee

Session 5

- 10h50 C. Geibel Magnetic frustration in intermetallic compounds
11h30 R. Dronskowski Complex Magnetic Intermetallics and Nitrogen-Based Transition Metal Pseudo-Oxides by Quantum-Chemical and Synthetic Approaches
12h10 P. Deen Studies of novel magnetic order with neutron polarisation analysis

12h30 Lunch

- 14h00 Poster session at ILL19/20

15h00 Coffee

Session 6

- 16h30 M. Fourmigué From the Mott transition in transition-metal compounds to the spin-frustrated triangular or Kagomé lattices: a tentative review of molecular strategies
17h10 H. Yan Artificial magnetic materials grown in nanoscale templates
17h30 M. Kenzelmann Magnetically-induced ferroelectric polarization in a molecule-based quantum magnet

19h30 Dinner at the restaurant de la Bastille

Wednesday 5th March

Session 7

- 9h00 H. Kageyama Structural control of perovskite oxides by a gentle touch
9h40 M. Zayed Evidence of pressure induced phase transitions in the Shastry-Sutherland compound
 $\text{SrCu}_2(\text{BO}_3)_2$
10h00 P. Lemmens Comparing magnetic materials by Raman scattering: From dimers, chains, planes to the Kagome lattice

10h20 Coffee

Session 8

- 10h50 M. Johansson A synthesis strategy for finding new low-dimensional compounds
11h30 V. Simonet Magnetic properties of quaternary oxalates kagomé antiferromagnets

11h50 R. Klingeler Highly frustrated $S = 1/2$ spin chains near a quantum critical point
12h10 Y. Chapuis Spin dynamics in magnetically frustrated compounds

12h30 Lunch

Session 9

14h00 P. Strobel New rare earth pyrochlore-type oxides $\text{Ln}_2\text{BB}'\text{O}_7$ with $\text{B}^{3+}\text{B}'^{5+}$ counteranions
($\text{B} = \text{Sc, Ga}$; $\text{B}' = \text{Nb, Sb}$)

14h20 A.-A. Haghighirad Synthesis and crystal growth of vanadate pyrochlores and their physical properties

14h40 S. Singh Crystal growth, Magnetic and Raman Scattering Studies of some Sm based pyrochlores: $\text{Sm}_2\text{X}_2\text{O}_7$ ($\text{X} = \text{Ti, Zr and Mo}$)

15h00 R. Kremer Long Range Ferro- and Antiferromagnetic Ordering in the Pyrochlore $\text{Y}_2\text{Mn}_2\text{O}_7$: Revisited

15h20 J. Gardner Recent Neutron Scattering Results From Geometrically Frustrated Magnets

15h40 S. Bramwell Frustrated Pyrochlores: the Strange Case of Erbium Stannate

End of the workshop

Poster presentations

L. BOGANI	Coexistence of Spin-Glass-like and Single Chain Magnet Behaviours in a family of molecular magnetic chains
A. BORBA-ANTUNES	Magnetic transitions in $\text{Er}_x\text{Y}_{1-x}\text{Co}_{0.5}\text{Mn}_{0.5}\text{O}_3$ perovskites
A. BOURGEOIS	Electronic structure and Fermi surface topology of Na_xCoO_2
R. COLMAN	Frustration in the Olivines; Neutron Diffraction Studies of Mn_2SiO_4 and Ni_2SiO_4
M. CONTINENTINO	Please type the Structure and magnetism of homo-metallic ludwigites: $\text{Co}_3\text{O}_2\text{BO}_3$ versus $\text{Fe}_3\text{O}_2\text{BO}_3$
C. DARIE	Synthesis of Fe based langasites for magnetic studies
M. DE VRIES	The inelastic neutron spectrum of a $S = 1/2$ kagomé antiferromagnet
S. DEBRION	Effect of magnesium doping on the orbital and magnetic order in LiNiO_2
I. FELNER	Magnetism and Superconductivity in $\text{RuR}_2\text{-xCe}_x\text{Sr}_2\text{Cu}_2\text{O}_{10-\delta}$ (Ru-1222)
L. FENNER	Residual magnetic entropy of CuGa_2O_4 and CuAl_2O_4 spin glasses
A. JAGANNATHAN	Competition between frustration induced by exchange couplings and local environments in simple 2D quantum antiferromagnets
M. JOHNSON	Phonons in pyrochlore slab $\text{SrCr}_9\text{Ga}_{12-9x}\text{O}_{19}$
S. KRÄMER	^1H and $^{63,65}\text{Cu}$ high field NMR studies towards the microscopic structure of the frustration driven $1/3$ magnetization plateau of Azurite $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$
C. LIN	Growth and magnetic characterization of high quality a' - $\text{Na}_{0.75}\text{CoO}_2$ single crystals
T. LUMMEN	The crystal field of Tb^{3+} in $\text{Tb}_2\text{Ti}_2\text{O}_7$
K. MARTY	Magnetic excitations in the frustrated kagomé-like langasite $\text{Pr}_3\text{Ga}_5\text{SiO}_{14}$
R. MATHIEU	The quenched disorder in hole-doped manganites
B. MEHDAOUI	Influence of Mg^{2+} on the magnetic order of $\text{Mg}_x\text{Mn}_{3-x}\text{O}_4$ spinel ($0 \leq x \leq 2$)
C. PAYEN	Synthesis of the frustrated multiferroic MnWO_4
M. PREGELJ	Frustration, magnetic anisotropies and Neel ordering in tetrameric $\text{FeTe}_2\text{O}_5\text{Cl}$ system
B. SCHMIDT	Thermodynamic properties of the frustrated square-lattice J_1 - J_2 model in high magnetic fields
P. SINDZINGRE	Thermodynamic properties of the spatially anisotropic spin $1/2$ Heisenberg model on the kagomé lattice : comparison with Volborthite
A. SMONTARA	Thermal conductivity of the $\text{Ni}_5(\text{TeO}_3)_4\text{Br}_2$ single crystal
O. VOLKOVA	$\text{Na}_2\text{Cu}_5\text{Si}_4\text{O}_{14}$: a new quasi – one – dimensional ferrimagnet
S. ZHERLITSYN	Spin-strain coupling in $\text{NiCl}_2\text{-4SC}(\text{NH}_2)_2$ in the vicinity of the quantum critical points

List of participants.

Organizers are in yellow, invited speakers in blue.

Family Name	First Name	Affiliation	City	Country	Status
AIMO	Francesco	CNRS-LCMI	Grenoble	France	Student
ATTFIELD	J. Paul	University of Edinburgh	Edinburgh	UK	Senior
BARTLETT	Bart	University of California	Berkeley	USA	Senior
BERTHIER	Claude	High Magnetic Field Laboratory	Grenoble	France	organiser
BOGANI	Lapo	Institut Néel, CNRS	Grenoble	France	Postdoc
BÖHM	Martin	Institut Laue-Langevin	Grenoble	France	Senior
BORBA-ANTUNES	Arlei	LCMI, CNRS	Grenoble	France	Postdoc
BORDET	Pierre	Institut Néel, CNRS	Grenoble	France	organiser
BRAMWELL	Steven	University college London	London	UK	Senior
CEPAS	Olivier	LPTMC université Pierre et Marie Curie Paris VI	Paris	France	Senior
CHAPUIS	Yann	CEA/DSM/INAC/SPSMS	Grenoble	France	Student
CHRISTENSEN	Niels Bech	Laboratory for Neutron Scattering, ETHZ & PSI	Villigen	Switzerland	Postdoc
COLLIN	Gaston	Université Paris-Sud	Paris	France	Senior
COLMAN	Ross	University college London	London	UK	Student
CONTINENTINO	Mucio	Instituto de Fisica - UFF	Niteroi	Brazil	Senior
CRONIN	Lee	University of Glasgow	Glasgow	UK	Senior
DALMAS DE REOTIER	Pierre	CEA/DSM/INAC/SPSMS	Grenoble	France	Senior
DARIE	Céline	Institut Néel, CNRS	Grenoble	France	Senior
DE VRIES	Mark	EPFL-SB-IPMC-LQM	Lausanne	Switzerland	Postdoc
DEBRION	Sophie	Institut Néel, CNRS	Grenoble	France	Senior
DEEN	Pascale	Institut Laue-Langevin	Grenoble	France	Senior
DRONSKOWSKI	Richard	Institute of Inorganic Chemistry, RWTH Aachen	Aachen	Germany	Senior
FÅK	Björn	CEA/DSM/INAC/SPSMS	Grenoble	France	Senior
FELNER	Israel	Racah Institute of Physics	Jerusalem	Israel	Senior
FENNER	Laura	University college London	London	UK	Student
FOURMIGUE	Marc	Université de Rennes	Rennes	France	Senior
GALERA	Rose Marie	Institut Néel, CNRS-UJF	Grenoble	France	Senior
GARBARINO	Gaston	European Synchrotron Radiation Facility	France	France	Senior
GARDNER	Jason	NIST	Gaithersburg	USA	Senior
GEIBEL	Christoph	MPI for Chemical Physics of Solids	Dresden	Germany	Senior
GHIGNA	Paolo	Universita di Pavia	Pavia	Italy	Senior r

GREEDAN	John	BIMR, McMaster University	Hamilton	Canada	Senior
HAGHIGHIRAD	Amir-Abbas	University of Frankfurt am Main	Frankfurt am Main	Germany	Student
HARRISON	Andrew	Institut Laue-Langevin	Grenoble	France	organiser
HIPPERT	Françoise	LMGP	Grenoble	France	Senior
HORVATIC	Mladen	CNRS - GHMFL	Grenoble	France	Senior
JAGANNATHAN	Anuradha	Université Paris-Sud	Orsay	France	Senior
JOBIC	Stéphane	Institut des Matériaux Jean Rouxel, CNRS	Nantes	France	Senior
JOHNSON	Mark	Institut Laue-Langevin	Grenoble	France	Senior
JOHANSSON	Mats	Stockholm University	Stockholm	Sweden	Senior
JÖNSSON	Petra	Uppsala University	Uppsala	Sweden	Senior
JULIEN	Marc-Henri	Université Joseph Fourier		France	Senior
KAGEYAMA	Hiroshi	Kyoto University	Kyoto	Japan	Senior
KENZELMANN	Michel	Laboratory for Neutron Scattering, ETH & PSI	Villigen	Switzerland	Senior
KLANJSEK	Martin	LCMI, CNRS	Grenoble	France	Postdoc
KLINGELER	Rüdiger	IFW Dresden	Dresden	Germany	Senior
KRÄMER	Steffen	GHMFL - CNRS Grenoble	Grenoble	France	Senior
KREMER	Reinhard	MPI für Festkörperforschung	Stuttgart	Germany	Senior
LACROIX	Claudine	Institut Néel, CNRS	Grenoble	France	organiser
LEJAY	Pascal	Institut Néel, CNRS	Grenoble	France	organiser
LEMMENS	Peter	Institute for Condensed Matter Physics, TU Braunschweig	Braunschweig	Germany	senior
LEPETIT	Marie-Bernadette	CRISMAT	Caen	France	Senior
LHOTEL	Elsa	MCBT - Institut Néel CNRS		France	Senior
LIN	Chengtian	Max Planck Institute for Solid State Research	Stuttgart	Germany	Senior
LUMMEN	Tom	University of Groningen	Groningen	Germany	Student
LHULLIER	Claire	Université Pierre & Marie Curie	Paris	France	Senior
LOIRE	Mickaël	Institut Néel, stage M2, France			Student
MAIRE-AMIOT	Bernard	Institut Néel, CNRS	Grenoble	France	organiser
MARTY	Karol	University Joseph Fourier, Institut Néel	Grenoble	France	Student
MATHIEU	Roland	Royal Institute of Technology (KTH)	Stockholm	Sweden	Senio
MEHDAOUI	Boubker	Université de Rennes 1	Rennes	France	Student
MENDELS	Philippe	Lab. Physique des Solides, Univ. Paris-Sud	Orsay	France	Senior
MUGUERRA	Hervé	Institut Néel, MCMF, France			postdoc
NENERT	Gwilherm	CEA, SPSMS/MDN	Grenoble	France	postdoc
NGUYEN	Ha	Natioanal Tsing Hua University	Hsinchu	Taiwan	Student
NILSEN	Gøran	IPMC, Ecole Polytechnique Fédérale de Lausanne	Lausanne	Switzerland	Student
OPAGISTE	Christine	Institut Néel	Grenoble	France	Senior
PAYEN	Christophe	Université de Nantes - CNRS	Nantes	France	Senior

PREGELJ	Matej	Jožef Stefan Institute	Ljubljana	Slovenia	student
REVCOLEVSCHI	Alexandre	Université Paris XI	Orsay	France	Senior
RODRIGUEZ-CARVAJAL	Juan	Institut Laue-Langevin	Grenoble	France	Senior
RÕÕM	Toomas	National Institute of Chemical Physics & Biophysics	Tallinn	Estonia	Senior
SANCHEZ	Jean Pierre	CEA/INAC/SPSMS	Grenoble	France	Senior
SCHMIDT	Burkhard	Max-Planck-Institut für Chemische Physik fester Stoffe	Dresden	Germany	Senior
SIMONET	Virginie	Institut Néel, CNRS	Grenoble	France	Senior
SINDZINGRE	Philippe	Université Pierre & Marie Curie	Paris	France	Senior
SINGH	Surjeet	Université Paris-Sud	Orsay	France	Postdoc
SMONTARA	Ana	Laboratory for the Study of Transport Problems	Zagreb	Croatia	Student
STROBEL	Pierre	Institut Néel, CNRS	Grenoble	France	Senior
STUNAUT	Anne	Institut Laue-Langevin	Grenoble	France	Senior
VASILIEV	Alexander	Moscow State University	Moscow	Russia	Senior
VOLKOVA	Olga	Moscow State University	Moscow	Russia	Postdoc
YAN	Hongdan	TU Braunschweig	Braunschweig	Germany	Student
YAOUANC	Alain	INAC-CEA	Grenoble	France	Senior
ZAYED	Mohamed	LNS ETHZ & PSI	Villigen	Switzerland	Student
ZHERLITSYN	Sergei	Dresden High Magnetic Field Laboratory, Forschungszentrum Dresden-Rossendorf	Dresden	Germany	Senior
ZHITOMIRSKY	Mike	SPSMS, CEA	Grenoble	France	Senior
ZVYAGIN	Sergei	Dresden High Magnetic Field Laboratory/FZD	Dresden	Germany	Senior