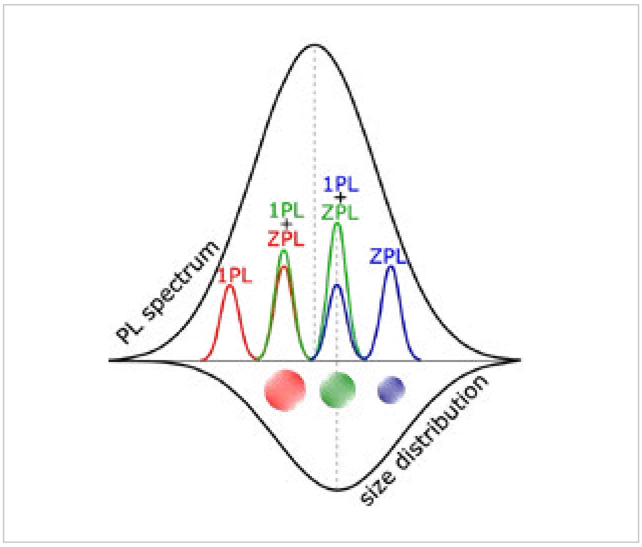
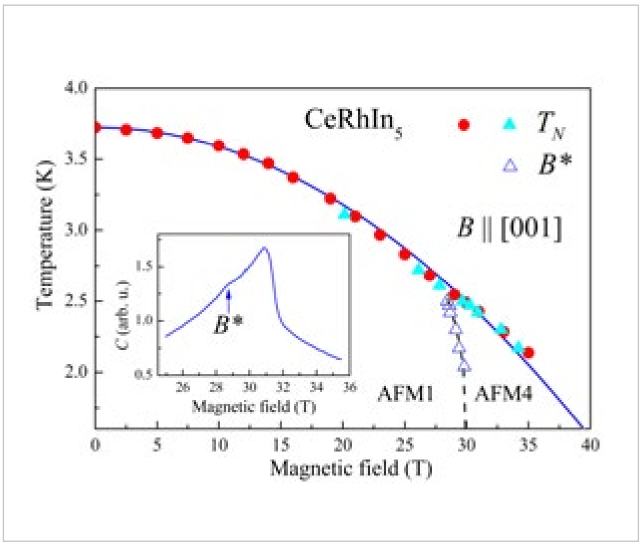
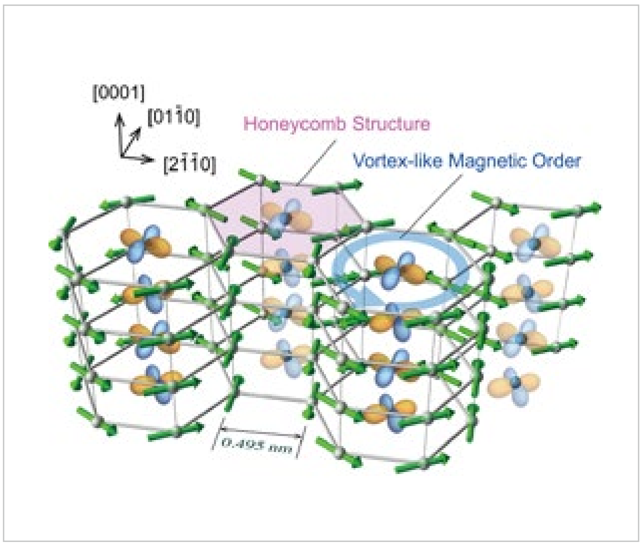
European Magnetic Field Laboratory

EMFLNEWS

N°1 2021







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www.emfl.eu

DEAR READER

Despite of the ongoing Corona pandemic, many high magnetic field activities continue in some way or another. The EMFL user meeting will take place on Tuesday, June 15, 2021 in a fully on-line format. An exciting one-day program will be put together, with talks reporting recent scientific results, the announcement of the winner of the 2021 EMFL prize, the meeting of the user committee, open for all users of the EMFL facilities, and the latest news from the European high-field scene, including the presentation of the ISABEL and Super-EMFL projects. These two H2020 projects are in full swing now and many new initiatives have started.

The new call for magnet time is out (deadline May 17, 2021) and contains, for the first time, a Dual Access procedure. This procedure invites users to apply both for first-step access to research equipment combined with moderate-field-range superconducting magnets and in a subsequent second step to the highest possible magnetic fields at one of the EMFL facilities. For the moderate-field experiments, EMFL has partnered, within the ISABEL project, with regional facilities distributed over Europe. These regional partners will be one-by-one introduced to you in the EMFLNEWS magazine, starting with the Materials Growth and Measurement Laboratory of the Charles University in Prague. This year also the EMFL secondment program will be re-introduced, aiming at the exchange of scientific and technical staff between institutions working on high magnetic field research. The duration of the stay can vary from a few weeks up to a few months. The call for secondment projects will be distributed soon with a submission deadline of September 30, 2021.

Take good care of yourself and your family, and we hope to see you soon at the user meeting or at one of the EMFL facilities.

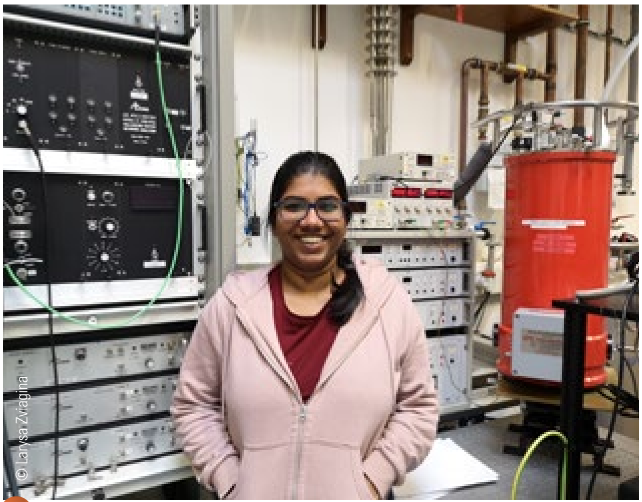
Peter Christianen
Director HFML
Chairman EMFL

MEET OUR PEOPLE

Lakshmi Bhaskaran, HLD

It was during my PhD work at the National High Magnetic Field Laboratory in Tallahassee that I first heard of the pulsed-field facility at HLD. The possibility of conducting experiments in very high magnetic fields, achieved within the time scale of milliseconds greatly excited me. Therefore, a dream came true when I got the offer of a postdoc position at HLD.

My research interest lies in investigating magneto-structural correlations, spin dynamics, and other exotic properties in a variety of materials. To explore these unfamiliar territories I primarily use the powerful microscopic probe of electron spin resonance (ESR) in both high magnetic fields and low temperatures. One of my most recent investigations was to understand the antiferromagnetic properties of Kitaev materials in a face-centered cubic lattice by employing ESR to uncover the quantitative and qualitative nature of the spin gap in these systems. What can turn the ESR technique into a challenging task is often the widespread non-availability of a broad range of THz sources. However, collaboration with the nearby ELBE – Center for High-Power Radiation Sources brings in the capabilities of free electron lasers (FEL). With access to far-infrared lasers and several other high-power THz sources, the portfolio of ESR techniques at HLD are truly outstanding. The time I spent here was enriched with a stimulating atmosphere, fruitful collaborations, and most of all the experience of performing experiments in a state-of-the-art facility.



Lakshmi Bhaskaran, HLD

THERMODYNAMIC SIGNATURE OF THE PUTATIVE ELECTRONIC-NEMATIC TRANSITION IN $CeRhIn_5$

Sanu Mishra, Albin Demuer, Ilya Sheikin, LNCMI Grenoble, and Dai Aoki, Tohoku University

Strongly correlated electron systems, such as high-temperature superconductors, iron-based superconductors, and heavy-fermion compounds, are of high experimental and theoretical interest. In these materials, unconventional superconductivity is believed to emerge near a quantum critical point. In addition, some of these materials host even more exotic phases. The latter include the pseudogap phase in high-T_c superconductors, an electronic-nematic state in iron-based superconductors, and the mysterious "hidden order" phase in the heavy-fermion compound URu_2Si_2. These phases are still poorly understood, and their possible relation to unconventional superconductivity is a subject of ongoing theoretical debate.

$CeRhIn_5$ is one of the best-studied heavy-fermion compounds. At ambient pressure and zero magnetic field, it undergoes an antiferromagnetic (AFM) transition at T_N = 3.8 K. When a magnetic field is applied along the c axis, T_N monotonically decreases until it is completely suppressed at about 50 T. The most interesting feature was observed in various measurements at B* ≈ 30 T for a field either applied along or slightly tilted from the c axis. While it was interpreted as a transition into an electronic-nematic state, the exact origin and nature of this anomaly is still under debate. Surprisingly, specific-heat measurements, so far, have failed to show a direct indication of this anomaly. It is, thus, still unclear whether the anomaly corresponds to a real thermodynamic phase transition or a crossover.

To address this issue, researchers from the LNCMI-Grenoble, together with their Japanese colleagues, performed high-field low-temperature specific-heat measurements on a single crystal of $CeRhIn_5$ in static fields up to 36 T. For the field applied along the c axis, they observed a distinct anomaly at B* (Figure), suggesting that a real thermodynamic phase transition, probably weakly first order, takes place at this field. The anomaly is observed only within the AFM state, which suggests that this transition is from the low-field incommensurate magnetic structure (AFM1) to another incommensurate phase (AFM4), presumably characterized by a different propagation vector. High-field inelastic neutron-scattering measurements are required to definitely confirm this hypothesis.

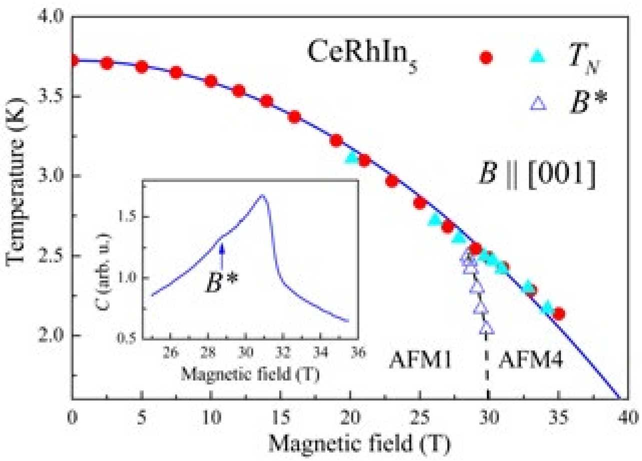


Figure: Magnetic phase diagram of $CeRhIn_5$ established from relaxation (circles) and AC (triangles) specific-heat measurements. Closed symbols correspond to second-order transitions from the AFM to PM phase. Open symbols indicate the anomaly at B*, which presumably corresponds to a weakly first-order transition. The inset shows an example of the specific-heat data measured at 2.42 K for a magnetic field applied along the c axis.

Specific heat of $CeRhIn_5$ in high magnetic fields: Magnetic phase diagram revisited, S. Mishra, A. Demuer, D. Aoki, and I. Sheikin, Phys. Rev. B **103**, 045110 (2021).

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POLARIZED EMISSION OF CdSe NANO-CRYSTALS IN STRONG MAGNETIC FIELDS: THE ROLE OF PHONON-ASSISTED RECOMBINATION OF THE DARK EXCITON

Dmitri Yakovlev and Peter Christianen, HFML Nijmegen

For a few decades, colloidal semiconductor nanocrystals have been the focus of intensive research. Due to the continuous progress in technology, nanocrystals with different sizes, shapes, compositions, and surface properties have been synthesized. Understanding their optical, electrical, and chemical properties has led to applications in various fields, such as light-emitting diodes, laser technology, field-effect transistors, solar cells, and biological labels. In these efforts, external magnetic fields have been used as a powerful tool not only to address magneto-optical properties and spin-dependent phenomena, but also to determine the basic optical properties of the nanocrystals, which are dominated by absorption and emission of coupled electron-hole pairs (excitons).

Usually, these experiments were performed on wet-chemically synthesized nanocrystals, showing a number of interesting magneto-optical effects: a field-induced shortening of the exciton lifetime, circular polarization of the photoluminescence emission, a fine-structure splitting of the exciton energy levels, including the Zeeman effect in single nanocrystals, an anisotropic electron-hole exchange interaction, and electron-spin coherence. However, these previous photoluminescence experiments also revealed several unusual appearances: (i) a spectral dependence of the photoluminescence circular polarization degree, (ii) its low saturation value, and (iii) a stronger intensity of the Zeeman component which is higher in energy. The latter feature is the most surprising being in contradiction with the thermal population of the exciton-spin sublevels.

To resolve these open questions a team of researchers of the TU Dortmund, the Ioffe Institute and the ITMO University, both in Saint Petersburg, and the High Field Magnet Laboratory (HFML-EMFL) in Nijmegen performed experiments on CdSe nanocrystals embedded in a glass matrix, a system that had not been investigated before in high magnetic fields. They measured polarized photoluminescence in magnetic fields up to 30 T and observed the same puzzling behavior as the earlier reports described above. The team developed a model that takes into account the cumulative contribution of both zero-phonon and phonon-assisted recombination of dark excitons to the emission spectra of the nanocrystal ensemble. This model describes well all unusual experimental findings and can be readily extended to other colloidal nanocrystals, whose inhomogeneous broadening exceeds the optical phonon energy. These results demonstrate the promising role that colloidal nanocrystals could play for spintronics and quantum-information applications based on spin-dependent phenomena.

Polarized emission of CdSe nanocrystals in magnetic field: the role of phonon-assisted recombination of the dark exciton, G. Qiang, A. A. Golovatenko, E. V. Shornikova, D. R. Yakovlev, A. V. Rodina, E. A. Zhukov, I. V. Kalitukha, V. F. Sapega, V. Kh. Kaibyshev, M. A. Prosnikov, P. C. M. Christianen, A. A. Onushchenko, and M. Bayer, Nanoscale **13**, 790 (2021).

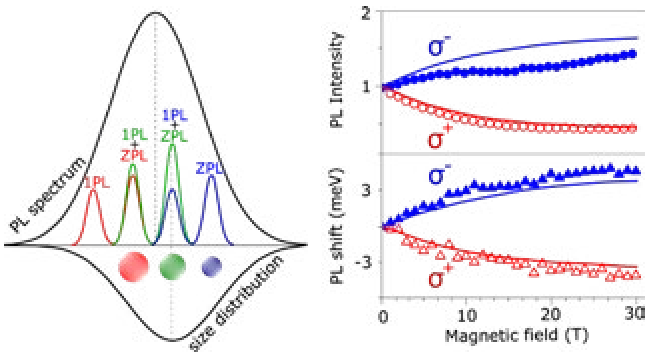

Figure: (Left panel) Photoluminescence spectrum of an ensemble of colloidal CdSe nanocrystals as a combination of zero-phonon (ZPL) and phonon-assisted (1PL) emission of differently sized quantum dots. This results in a peculiar behavior of the circularly polarized photoluminescence emission in high magnetic fields: the higher energy, σ-polarized exciton level has a higher intensity (blue curves in right panel).

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SPIN-VALLEY-SPLIT SHUBNIKOV-DE HAAS OSCILLATIONS IN WSe_2 MONOLAYERS

Banan Kerdi, Mathieu Pierre, Michel Goiran, and Walter Escoffier, LNCMI Toulouse

Transition-metal dichalcogenides (TMDCs) are two-dimensional layered materials showing intriguing electronic properties, especially when thinned down to a single layer. We studied WSe_2 monolayers fabricated at LNCMI-Toulouse through transport measurements.

We measured the magnetoresistance at 4.2 K under pulsed magnetic fields up to 55 T for several hole densities. We attribute the complex Shubnikov-de Haas oscillations to a partially resolved, large Zeeman splitting of the valence band in this material, thanks to the presence of heavy tungsten atoms as well as electronic interactions.

We developed a model to simulate the magnetoresistance oscillations, in which the main parameter is the ratio between the Zeeman energy E_z and the cyclotron energy E_c. It takes into account the Landau levels (LLs) from both valleys (i.e., |K ↑> and |K' ↓> states, due to spin-valley locking) with the same Gaussian broadening.

Although a shift of ±2 of E_z/E_c gives the same apparent splitting between the |K ↑> and |K' ↓> LLs, we could determine the value of this ratio by studying (i) the relative amplitude of the resistance oscillations, corresponding to the crossing of the chemical potential with the LLs, which depends on their index; (ii) the transition from a mixed to a polarized LL regime which takes place at a critical field depending on E_z/E_c. We found that the Zeeman energy is several times larger than the cyclotron energy.

Our model relies on the Landau-level spectrum of the charge carriers. In TMDC monolayers, the nature of the charge carriers as Schrödinger fermions (SCHFs) or massive Dirac fermions (MDFs) remains controversial. Regarding their LL spectrum, the main difference lies in the double degeneracy of the zeroth Landau level. The choice of the fermion model translates into a shift of 1 of E_z/E_c.

The effective Landé factor of the holes is computed from $g^* = 2 \times m_e/m^* \times E_z/E_c$. In the explored range of hole densities (between 7.5 and 5×10^{12} cm^{-2}), this factor ranges between 14.7 and 17.3 for MDFs and between 19.1 and 21.8 for SCHFs, considering a constant effective mass ($m^* = 0.45 \times m_e$) of the holes. g^* follows the trend previously reported in the literature and is found to increase when the hole density is reduced, confirming the importance of electronic interactions in understanding the electronic properties of this material.

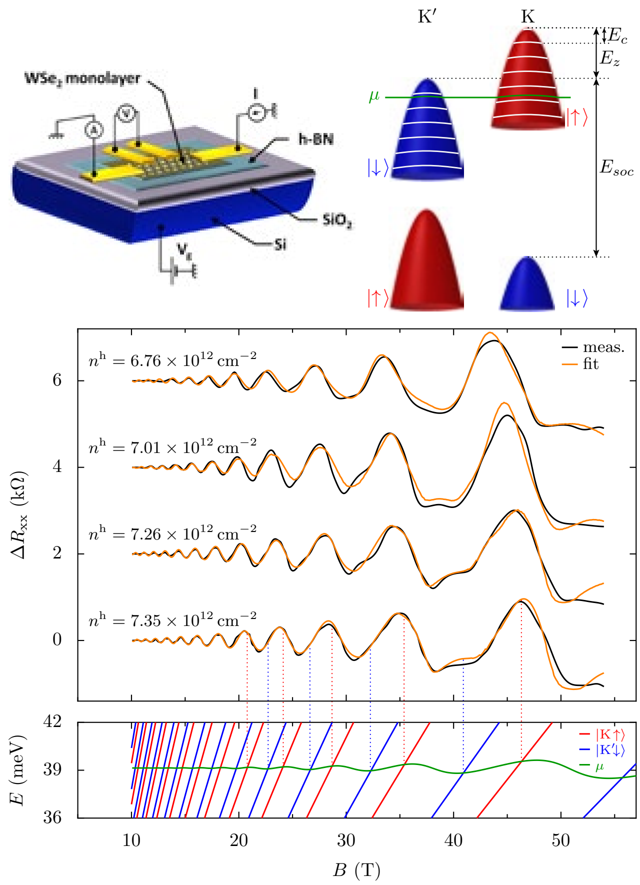

Figure: (Top) Sketch of the WSe_2 monolayer sample and simplified structure of the valence band in a magnetic field. (Middle) High-field magnetoresistance of the sample at T = 4.2 K, after background removal, for various values of the hole density. The fit obtained with our model is superimposed. The complex oscillation pattern appearing at high magnetic field due to a non-integer E_z/E_c ratio is well reproduced. (Bottom) Spectrum of the Landau levels of both spin/valley indices and simulated evolution of the chemical potential μ(B).

High magnetic field spin-valley-split Shubnikov–de Haas oscillations in a WSe_2 monolayer, B. Kerdi, M. Pierre, R. Cours, B. Warot-Fonrose, M. Goiran, and W. Escoffier, Phys. Rev. B **102**, 155106 (2020).

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ELECTRIC QUADRUPOLAR CONTRIBUTIONS IN THE MAGNETIC PHASES OF UNi_4B

Tatsuya Yanagisawa, Hokkaido University and Sergei Zherlitsyn, HLD Dresden

Researchers from Japan and the Czech Republic, together with scientists from the HLD, have succeeded in identifying that electric quadrupoles play an important role in the magnetic order of the honeycomb-layer compound UNi_4B. The scientists showed that these quadrupoles maintain their degrees of freedom without ordering at the center of a magnetic vortex arrangement (left panel in the figure).

In this study, the cooperation partners combined ultrasound technique, which can sensitively detect orbital degrees of freedom, with the advanced high-magnetic-field generation equipment at the HLD and the High Field Laboratory for Superconducting Materials at Tohoku University. The researchers performed precise measurements of the electric quadrupoles derived from the orbital degrees of freedom in the vortex magnetic state of UNi_4B. They observed strong correlations between the magnetic vortices and electric quadrupoles.

The elastic constants show large variations in magnetic-field regions where the vortex magnetic structure changes. This indicates that the quadrupole response evolves rapidly in magnetic field (right panels in the figure). Here, phase II represents a magnetic-toroidal dipolar order showing a vortex magnetic structure. The response of the quadrupoles depends strongly on the in-plane direction of the applied magnetic field. For H || [01-10], a phase V, which does not exist for H || [2-1-10], appears at high magnetic fields and low temperatures. Further, the contour plot shows a significant difference in the elastic constant C_{66} for the two field directions, although there is no difference in the magnetization. From the blue and red contrasts in the ordered phases, we can conclude that the electric quadrupoles play an important role in the vortex-like magnetic structure of this system, modifying the spin-reorientation process as well.

These findings advance our understanding of the fundamental phenomena related to the interaction between quadrupolar degrees of freedom and magnetic vortices. This might provide a cornerstone for the realization of completely new quantum-information devices that control electronic degrees of freedom in solids in future applications.

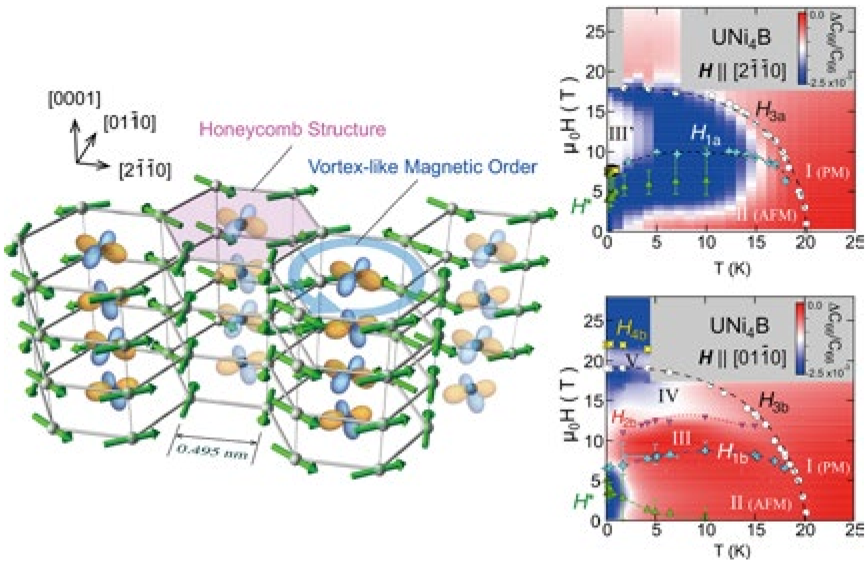

Figure: (Left panel) Crystal structure, magnetic vortices, and electric quadrupoles in UNi_4B. Magnetic field-temperature phase diagram with magnetic field applied along [01-10] (right, lower panel) and along [2-1-10] (right, upper panel). The color code indicates the changes in the elastic constant C_{66}.

Electric Quadrupolar Contributions in the Magnetic Phases of UNi_4B, T. Yanagisawa, H. Matsumori, H. Saito, H. Hidaka, H. Amitsuka, S. Nakamura, S. Awaji, D. I. Gorbunov, S. Zherlitsyn, J. Wosnitza, K. Uhlířová, M. Vališka, and V. Sechovský, Phys. Rev. Lett. **126**, 157201 (2021).

Contact: tatsuya@cris.hokudai.ac.jp

OPENING OF THE CALL FOR ACCESS NO. 25

Although all EMFL sites have resumed user operation, the COVID-19 crisis is still causing serious restrictions. Quite a number of the accepted and scheduled proposals could not be performed, mainly due to travel restrictions. Nevertheless, the Board of Directors decided to stick to the regular policy that proposals will remain valid for one year. Users with older proposals, that could not be executed, are asked to resubmit them. This concerns proposals granted in the call 120 and older. This facilitates the handling of all proposals and provides maximum clarity to all users and funding agencies.

The 25th call for proposals has been launched on April 15, 2021, inviting researchers worldwide to apply for access to one of the large installations for high magnetic fields collaborating within EMFL.

The four facilities

> LNCMI - Grenoble - France: Static magnetic fields up to 36 T
> HFML - Nijmegen - the Netherlands: Static magnetic fields up to 38 T
> HLD - Dresden - Germany: Pulsed magnetic fields to beyond 95 T
> LNCMI - Toulouse - France: Pulsed magnetic fields of long duration to beyond 99 T and on the microsecond scale to beyond 200 T

run a joint proposal program, which allows full access to their installations and all accompanying scientific infrastructure to qualified external users, together with the necessary support from their scientific and technical staff.

Users may submit proposals for access to any of these installations by a unified procedure. The online form for these proposals can be found on the EMFL website.
www.emfl.eu/user

In the frame of the EU-funded ISABEL project, EMFL will trial a novel **Dual Access** procedure starting from this call. Please see page 9 for more details.

Please note that each experiment carried out must be followed up by a progress report and your publication record filled out online on the EMFL website. Please be aware that this information will also be made available to the Selection Committee.

To improve our user program further, your feedback to the user committee is highly appreciated.
Please find the form on the EMFL website.
https://emfl.eu/SelCom/UserCommittee/feedbackform.php

The deadline for proposals for magnet time is May 17, 2021.

Proposals received after the deadline, which are considered of sufficient urgency, may be handled as they arrive and fit into any available time.

The proposals will be evaluated by a Selection Committee. Selection criteria are scientific quality (originality and soundness), justification of the need for high fields (are there good reasons to expect new results) and feasibility of the project (is it technically possible and are the necessary preparations done). It is strongly recommended to contact the local staff at the facilities to prepare a sound proposal and ideally indicate a local contact.

Please do acknowledge any support under this scheme in all resulting publications with „We acknowledge the support of the HFML-RU/FOM (or HLD-HZDR or LNCMI-CNRS), member of the European Magnetic Field Laboratory (EMFL)." UK users should, in addition, add „A portion of this work was supported by the Engineering and Physical Sciences Research Council (grant no. EP/N01085X/1)."

> You may find more information on the available infrastructures for user experiments on the facility websites.

www.hzdr.de/hld
www.lncmi.cnrs.fr
www.ru.nl/hfml

EMFL
European Magnetic Field Laboratory

The EMFL develops and operates world class high magnetic field facilities, to use them for excellent research by in-house and external users.

USER MEETING 2021

After the cancellation of the user meeting in 2020, the EMFL Board of Directors is happy to announce that this year a user meeting of the European high field magnet facilities for

- continuous fields (LNCMI Grenoble and HFML Nijmegen) and
- pulsed magnetic fields (HLD Dresden and LNCMI Toulouse)

will take place on Tuesday, June 15, 2021 in video format. The aim of the meeting is to exchange ideas and experiences, to present scientific results, and to discuss possibilities for improving the facilities' attractiveness. During the meeting, there will be introductory talks on the EU-funded projects ISABEL and SuperEMFL, important for the future development of EMFL, as well as invited scientific talks from selected users.

We would like to involve you, our users, in this meeting; please inform us of specific needs in terms of new equipment or facility developments you have today or may have in the future, so that we could provide you with the corresponding information during the meeting. Do not hesitate to suggest topics that you would like to discuss during the meeting.

As an important part of the user meeting, the User Committee meeting will take place that Raivo Stern will chair (National Institute of Chemical Physics & Biophysics, Tallinn, Estonia).

The user committee has an online feedback form for all users **https://emfl.eu/SelCom/UserCommittee/feedbackform.php**

In addition, users can contact the user committee directly via e-mail: raivo.stern@kbfi.ee

We will distribute the video link to access the meeting via email in due time. There is no registration needed.

Program (preliminary)

09:00	Welcome (Peter Christianen)
09:10	**Announcement of the 2021 EMFL prize winner** (Jochen Wosnitza)
	Presentation by the 2021 EMFL prize winner
09:40	**Presentations by EMFL users – session 1** (including 30 min coffee break)
11:50	Lunch break
12:50	**Presentations by EMFL users – session 2**
13:50	**Introduction to the ISABEL project**
14:10	**Introduction to the SuperEMFL project**
14:30	Coffee break
14:45	**User Committee Meeting** (open to all users, chaired by Raivo Stern)
15:45	**Report of User Committee to the Board of Directors**
16:00	Wrap up and closure

NOVEL ACCESS PROCEDURE TO THE EMFL: DUAL ACCESS

EMFL would like to announce to its users an extended and tailored range of new access procedures that we will implement within the ISABEL project. For this purpose, there will be a survey addressed to the user community in the near future. In the course of 2021, novel access procedures, such as first-time, fast-track, long-term, and industrial-user access will be announced on the EMFL and ISABEL websites as well as integrated into the EMFL online proposal submission system.

At this point, however, we would like to announce that ISABEL will trial a novel **Dual Access** procedure already starting from the first call in 2021. This procedure will invite users at an early stage of their research projects and will lower the barrier for access as well. Within one experiment proposal, users will have the possibility to apply both for first-step access to research equipment dedicated to the moderate-field range accessible with superconducting magnets, and in a subsequent second step to the highest possible magnetic fields at the EMFL installations in Grenoble, Nijmegen, Toulouse, and Dresden. For performing experiments in the moderate-field range, thanks to the ISABEL project, EMFL has partnered with well-equipped and experienced regional facilities distributed over Europe. In this way, the dual-access procedure will particularly support such users that, so far, have had inadequate access to superconducting magnets. In the next issues of the EMFLNEWS we will profile the regional facilities:

- Superconducting magnet laboratory, University of **Nottingham (UNOT)**
- Oxford Centre for Applied Superconductivity, University of **Oxford (UOXF)**
- Nicholas Kurti High Magnetic Field Laboratory, University of **Oxford (UOXF)**
- Laboratory of Low Temperatures and High Magnetic Fields, Universidad Autonoma de **Madrid (UAM)**
- Research Laboratories of the Faculty of Physics, University of **Warsaw (UWAR)**
- Materials Growth and Measurement Laboratory, Charles University, **Prague (UCHA)**
- Research Facilities of the National Institute of Chemical Physics and Biophysics, **Tallinn (NICPB)**
- Spintronics and Nanomagnetism Laboratory, University of Salento, **Lecce (USAL)**

How to apply for Dual Access

Proposals will be submitted within the periodic EMFL calls. The EMFL Selection Committee will judge the scientific pertinence of the proposed low-field experiments and high-field experiments together and will grant conditional access to the EMFL installations in one statement. It is foreseen that local-support experts at the EMFL facilities will finally decide on performing the subsequent experiments at the EMFL high-field facilities, depending on whether the scientific need to continue the project at very high magnetic fields has been proven.

ISABEL will provide limited financial support for experiments at regional and EMFL facilities that participate in the dual access trial. Inquiries for use of regional facilities should be directed in the first instance to the local contacts of the regional facilities.

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INTRODUCING OUR REGIONAL PARTNER FACILITIES

Materials Growth and Measurement Laboratory, Charles University (Prague)

The Materials Growth and Measurement Laboratory (MGML) is a large research infrastructure operated by the Faculty of Mathematics and Physics, Charles University, in cooperation with the Institute of Physics of the Czech Academy of Sciences. The main research focus is condensed-matter physics and materials sciences. More specifically, it involves the studies of novel electronic states, phase transitions including quantum phase transitions, topological insulators and superconductors, magnetism and unconventional superconductivity, ferroic, multiferroic, magnetocaloric, and magnetic shape-memory materials. It offers open access to its laboratories:

Synthesis and characterization of materials, particularly metals, intermetallics, semimetals, oxides, and inorganic salts. Crystal growth by using several complementary techniques: Czochralski, Bridgman, floating-zone (mirror or laser furnace), flux-growth, chemical vapor transport, and hydrothermal growth. Modern DTA/DSC analysis, electron microscopes, and x-ray diffraction instruments (operating in the range between 3 and 1200 K) allow a detailed structural and phase characterization of samples.

Measurement of physical properties, namely magnetization, AC magnetic susceptibility, heat capacity, electrical resistivity, magnetoresistance, electrical capacity, permittivity, magnetoelectric response, Hall resistivity, thermal conductivity, Seebeck effect, thermal expansion, magnetostriction, and using various force-microscopy techniques.

The extensive range of the MGML instruments makes it possible to carry out these measurements at temperatures from mK up to several hundred degrees Celsius, in magnetic fields up to 20 T, electric fields from -50 V to +50 V, and under hydrostatic and uniaxial pressures up to 15 GPa.

MGML holds an official license for onsite manipulation of materials containing U and Th for research purposes, allowing the synthesis and measurement of materials containing these elements.

Details of all the instrumental equipment including compatible sample environment can be found on the webpage **mgml.eu**.

Contact: Martina Rážová (m.razova@mag.mff.cuni.cz)

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UPCOMING EVENTS

1. CM&LTP 2021, Condensed Matter and Low Temperature Physics 2021, Kharkiv, Ukraine, June 6-12, 2021.
http://ilt.kharkov.ua/cmltp2021/index.html

2. EMFL user meeting 2021, Dresden, Germany, June 15, 2021. **VIRTUAL**
https://emfl.eu

3. DPG Meeting of the Condensed Matter Section, Berlin, Germany, probably September 26-October 1, 2021. **VIRTUAL**
https://www.dpg-physik.de/aktivitaeten-und-programme/tagungen/fruehjahrstagungen/herbst_2021

4. EAPPC-BEAMS-MEGAGAUSS 2021, Biarritz, France, August 29-September 2, 2021.
http://eappc-beams2020.org/

5. MT27, International Conference on Magnet Technology, Fukuoka, Japan, November 15-19, 2021. **HYBRID**
http://csj.or.jp/conference/MT27/

6. International Conference on Magnetism (ICM), Shanghai, China, July 3-8, 2022. **SHIFTED**
http://www.icm2021.com/

7. International Conference on the Physics of Semiconductors (ICPS), Sydney, Australia, June 26- July 1, 2022.
https://www.icps2022.org/

8. 29th International Conference on Low Temperature Physics (LT29), Sapporo, Japan, August 2022. **SHIFTED**
http://www.lt29.jp

Biarritz

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The EMFL develops and operates world class high magnetic field facilities, to use them for excellent research by in-house and external users.

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