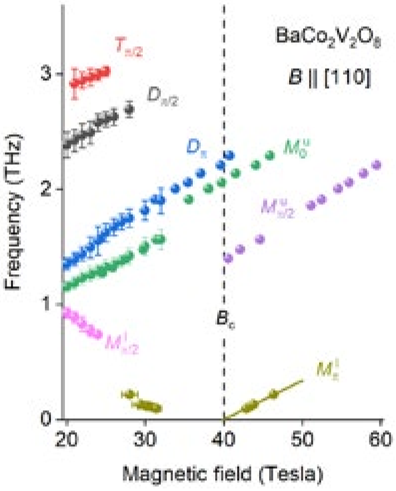
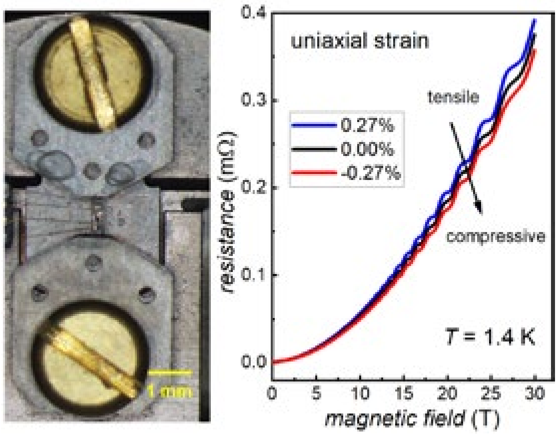
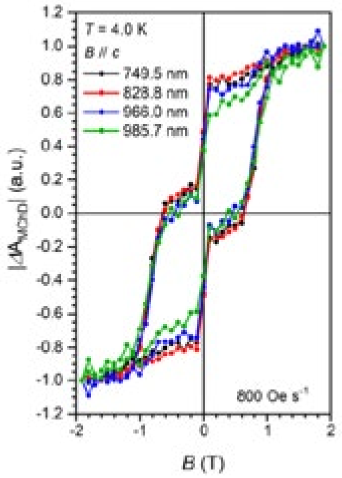
EMFL
European Magnetic Field Laboratory

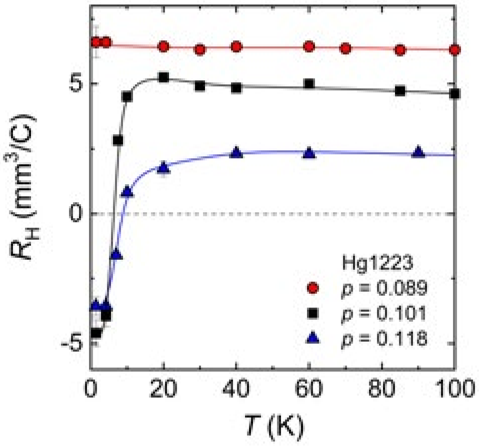
EMFLNEWS

N°3 2024









CONTENTS

DEAR READER

We are delighted to present the November edition of EMFLNews, a unique opportunity to share with you the latest exciting developments from our international laboratory. In this issue, we highlight the recent scientific achievements of our research teams. As with every issue, we have the privilege to introduce you to a prominent member of our laboratories. This time, it is Barbara Evertsen, from Nijmegen, who is our new Executive Manager.

I would also like to mention the opening of our call for access number 32 and the cooperation between the EMFL and Japan, which gives EMFL users the opportunity to carry out pulsed-field experiments beyond 500 T in Japan. This issue also focuses particularly on two aspects that are important to us at the EMFL. Firstly, we highlight our ongoing commitment to supporting industrial activities involving intense magnetic fields. This issue features the company MAGNOTHERM.

Secondly, we give some information about the EMFL Days, which were organized this year in Prague by our colleagues from Dresden and the EMFL School, which was also organized in Dresden this year.

We hope you enjoy the dynamism and achievements of EMFL described in this issue.

On behalf of the whole team, I wish you a very pleasant autumn 2024.

Charles Simon
Director LNCMI
Chairman EMFL

MEET OUR PEOPLE

Barbara Evertsen, HFML-FELIX

After finishing gymnasium in Haarlem, I went to study geology in Amsterdam. While completing my study, I started working as a geotechnical consultant for about ten years. The next six years, I was working for the Knowledge Centre Science and Technology, including three years as program manager for the Faculty of Science of the HAN University of Applied Sciences. In 2014, I started as operation manager for the Radboud Pre-University College of Science. In 2022, this job merged into the position of Managing Director of the Institute for Science Education. In April this year, I was appointed as Managing Director of HFML-FELIX responsible for the overall management of the institute, particularly in the areas of finance, HRM, project management, communication, external relations, and facility management.

I am married with Rogier, besides being a great husband he is also a chemist and physicist with PhD involving laser technology, which is very convenient for me while working for HFML-FELIX. Together we have two children: Jonathan is a 3rd year student of mechanical engineering in Delft and Eliza just started high school. Besides work, I love to read, go to museums, and enjoy family time. I am looking forward to join the EMFL family, to get acquainted with the organisation, getting to know you and the laboratories, and to contribute to strengthening the European cooperation.

© Barbara Evertsen

› *Barbara Evertsen*

OPTICAL READOUT OF SINGLE-MOLECULE-MAGNETS MAGNETIC MEMORIES WITH UNPOLARIZED LIGHT

Cyrille Train and Matteo Atzori, LNCMI-Grenoble

Magnetic materials are widely used for many technologies in areas such as energy, health, transportation, computation, and data storage. For the latter, the readout of the magnetic state of a medium is crucial. Optical readout based on the magneto-optical Faraday effect was commercialized, but soon abandoned because of the need for a complex circular polarization-sensitive readout. In this work, we demonstrate that this obstacle can be removed combining chirality with magnetism as chiral magnetic materials exhibit magneto-chiral dichroism (MChD), a differential absorption of unpolarized light dependent on their magnetic state.

By using molecular-chemistry principles, we have rationally implemented chirality into single-molecule magnets (SMMs), ultimate nanoobjects capable of retaining magnetization. Then, we have characterized the magnetic properties of this system through temperature- and magnetic-field-dependent magnetic measurements on single crystals, revealing an opening of the hysteresis cycle at low temperature (4.0 K) as a consequence of a strong axial magnetic anisotropy of the used Dy ion. Magneto-chiral-dichroism studies as a function of temperature- and applied magnetic field, whose polarity is changed at frequencies varying between 0.01 and 0.1 Hz (with sweep rates of 800 - 8000 Oe s^{-1}), revealed sharp and strong MChD signals associated with the f-f electronic transitions of the Dy ion.

To allow a direct comparison between MChD and magnetization curves and to probe the retention of the magnetization of the system with unpolarized light through MChD, we have adapted the measurement protocol for the investigation of MChD in dynamic conditions. It consists of sweeping the magnetic field with a triangular profile up and down between opposite polarities (±2 T in the present case, but extendable to ±7 T using the LNCMI resistive magnets) and measuring continuously light-absorption spectra, similarly to what is done in magnetic-hysteresis measurements performed with a magnetometer. This protocol provides high-resolution/high-sensitivity MChD spectra that allow accurate probing of the optical response of the system during the magnetic-field sweep.

The magneto-chiral optical data accurately reproduce the hysteresis cycle (figure 1a) and the fine features associated with the quantum tunneling of the magnetization at zero field (figure 1b). The temperature dependence of the hysteresis opening follows the magnetometry findings (figure 1c) and the same behavior can be probed at different wavelengths (figure 1d). This clearly demonstrates that upon implementation of chirality in SMM, unpolarized light is able to probe the magnetic information stored in SMMs through MChD, even at zero field. This study, thus, represents a paradigm shift in the field of optical-data readout. It can indeed be considered as a proof of concept for the readout of the information stored in ultimate small dimensions of magnetic molecular memories and paves the way for the development of novel polarization-free optical-data readout technologies.

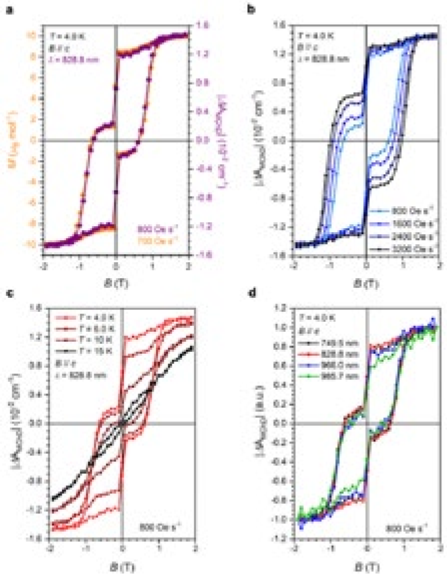


Figure: (a) Comparison between the magneto-chiral optical data extracted by MChD measurements (purple dots) and magnetization measurements (orange dots) as a function of B. (b) Variation of the opening of the hysteresis loop detected by unpolarized-light irradiation under magnetic field for various magnetic-field sweep rates at T = 4.0 K and (c) for different temperatures. (d) Magneto-chiral optical response for different wavelengths at the same temperature and sweep rate.

Optical Readout of Single-Molecule Magnets Magnetic Memories with Unpolarized Light, M. S. Raju, K. Paillot. I. Breslavetz, G. Novitchi, G. L. J. A. Rikken, C. Train, and M. Atzori, J. Am. Chem. Soc. **146**, 23616 (2024).

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STRETCHED AND COMPRESSED – QUANTUM MATERIALS UNDER EXTREME CONDITIONS

J. F. Linnartz, A. Kool, S. Wiedmann, HFML Nijmegen and IMM Radboud

Quantum materials often exhibit remarkable sensitivity to subtle changes in their physical environment, a feature that can unlock new functionalities and drive innovative applications. One key phenomenon is magneto-elastoresistance, where the electrical resistance of a metal in a magnetic field changes when the material is stretched or compressed. However, understanding this effect can be tricky, especially in materials with complex internal structures. A team of researchers from the University of Amsterdam, Princeton University, and HFML-FELIX has investigated the material ZrSiSe, and their findings offer fresh insights into how quantum materials react to uniaxial strain.

In recent years, the use of uniaxial strain has proven to be a powerful method for exploring new phenomena in various quantum materials, including superconductors and narrow-band-gap materials, often using commercially available strain cells. One key advantage of uniaxial strain is that it can be varied continuously and, unlike chemical doping, it does not naturally introduce extra disorder into the material under investigation.

In their study, the researchers explored two key properties that a quantum material can exhibit under high magnetic fields: magnetoresistance, the change in a material's electrical resistance, and Shubnikov-de Haas quantum oscillations. They focused on ZrSiSe, a Dirac nodal-line semimetal, due to its large magnetoresistance and the known sensitivity of its Fermi surface to external tuning parameters.

Magneto-elastoresistance, which refers to the change in resistance when strain is applied in a magnetic field, provides valuable insights into the electrical-transport properties of quantum materials. The researchers discovered that even a small stretch (0.27%) led to a significant change (7%) in the material's resistance in a magnetic field (figure). Their analysis revealed that this effect is primarily driven by the ease with which electric charges move through the material and that this mobility changes in direct proportion to the applied strain

In addition, the researchers used a phenomenon called Shubnikov-de Haas oscillations to gain deeper insights into changes in the Fermi surface and the behavior of quasiparticles. This method revealed more details about how the material's electronic structure, particularly the quasiparticles located in distinct electron and hole pockets, responds to strain and magnetic fields.

These findings demonstrate not only how to precisely control, describe, and understand the electronic properties of ZrSiSe under uniaxial strain but also highlight that the combination of uniaxial strain and high magnetic fields is a powerful tool for studying quantum materials.

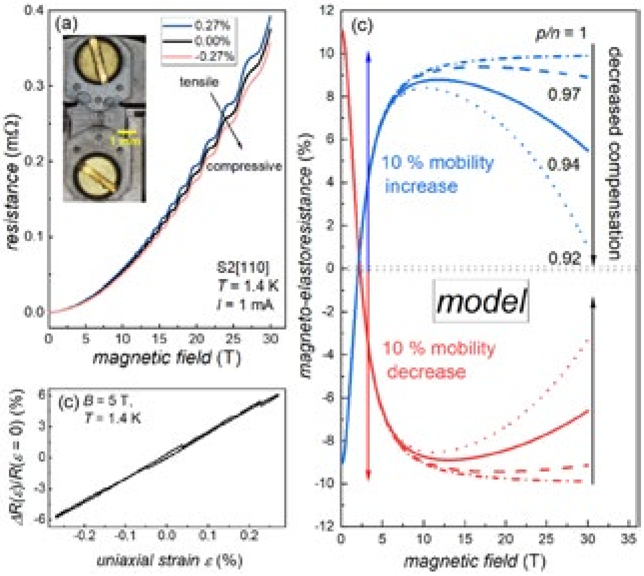

Figure: (a) Resistance under uniaxial strain (inset device) at 1.4 K. (b) Strain-induced change in electrical resistance. (c) Two-carrier model for explaining the magneto-elastoresistance.

Unraveling magneto-elastoresistance in the Dirac nodal-line semi-metal ZrSiSe,
J. F. Linnartz , A. Kool, J. P. Lorenz, C. S. A. Müller, M. R. van Delft, R. Singha, L. M. Schoop, N. E. Hussey, A. de Visser and S. Wiedmann, npj Quantum Mater. **9**, 63 (2024).

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CHARGE ORDER NEAR THE ANTIFERROMAGNETIC QUANTUM CRITICAL POINT IN THE TRILAYER HIGH-TC CUPRATE $HgBa_2Ca_2Cu_3O_{8+\delta}$

V. Oliviero, D. Vignolles, C. Proust, LNCMI Toulouse, W. A. Atkinson, Trent University, Canada

The ubiquity of the interplay between antiferromagnetic (AFM) order, charge density waves (CDWs), and superconductivity is a general feature of hole-doped cuprates. The role of AFM order is still strongly debated, although the pairing mechanism is widely accepted to be of magnetic origin. In a recent work, we studied the trilayer cuprate $HgBa_2Ca_2Cu_3O_{8+\delta}$ (Hg1223), in which the inner CuO_2 plane is protected from out-of-plane disorder and, therefore, is extremely clean and free of distortions.

Figure 1 shows the evolution of the Hall coefficient (at 85 T). For hole doping of p = 0.118 and p = 0.101, there is a sudden sign change of the Hall coefficient below about 10 K that is not observed at lower doping. In YBCO, this sign change has been attributed to a small closed electron pocket coming from a Fermi-surface reconstruction by charge order. Here, the abruptness of the transition and its low temperature are surprising. We were able to track the Fermi-surface morphology through the transition using quantum-oscillation measurements. Figure 2a shows the evolution of the quantum oscillations at different temperatures for p = 0.112. At 4.2 K, there is a strong low-frequency oscillation, whose amplitude decreases with decreasing temperature. At 1.75 K, those oscillations are weaker and small-amplitude oscillations at higher frequencies have emerged. This is inconsistent with the Lifshitz–Kosevich theory and signals a Fermi-surface reconstruction. The temperature evolution of the oscillation spectrum is visible in the Fourier analysis of the oscillatory part of the data (figure 2b).

To gain more insight on this sudden change of the Hall effect and quantum-oscillation spectrum evolution, we numerically simulated quantum oscillations of the density of states. These calculations point to a Fermi-surface reconstruction in the inner plane from an AFM state (hole pockets) to a biaxial CDW (electron pocket). A remarkable implication of our work is that AFM and CDW compete because they share the same Fermi-surface “hot spots”. This coincidence is a key feature of a spin-fermion model, in which charge order is mediated by critical spin fluctuations and which supports magnetically mediated pairing interaction in cuprates.

Charge order near the antiferromagnetic quantum critical point in the trilayer high Tc cuprate $HgBa_2Ca_2Cu_3O_{8+\delta}$, V. Oliviero, I. Gilmutdinov, D. Vignolles, S. Benhabib, N. Bruyant, A. Forget, D. Colson, W. A. Atkinson and C. Proust, npj Quantum Materials **9**, 75 (2024).

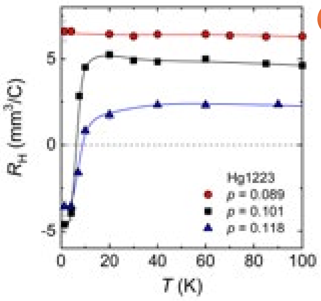

Figure 1: Temperature dependence of the normal-state Hall coefficient R_H, measured at 85 T in Hg1223 for p = 0.089, p = 0.101, and p = 0.118. At p = 0.101 and p = 0.118, R_H changes sign abruptly below 10 K, while it remains positive down to the lowest temperature for p = 0.089.

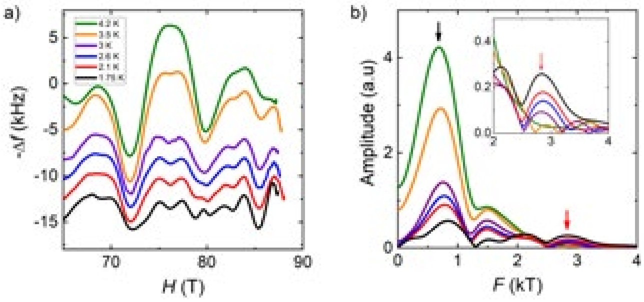

Figure 2: (a) Quantum-oscillatory signal (TDO) for p = 0.112. (b) Discrete Fourier analysis of the oscillatory signal shown in panel (a) between 70 and 87 T. The black (red) arrow marks the low (high) frequency observed at 4.2 K (1.8 K). The broadening of the Fourier transform at low frequency comes from the small number of oscillations in the field range. The inset shows a zoom of the Fourier transform between 2 and 4 kT, where one can clearly see the emergence of two peaks at F = 2100 T and F = 2800 T (red arrow).

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EXPERIMENTAL OBSERVATION OF REPULSIVELY BOUND MAGNONS

Sergei Zvyagin, HLD

The importance of attractive forces, stabilizing multi-particle bound states in condensed matter is generally accepted. By contrast, multi-particle bound states stabilized by means of repulsive forces were long thought to be only theoretical constructions, due to the strong dissipative channels present in real materials.

Recently, Zhe Wang from the Department of Physics at Technical University (TU) Dortmund, in collaboration with researchers from Augsburg, Bonn, Cologne, Dresden, Geneva, and Prince George (Canada), proved experimentally the existence of repulsively bound magnons in the Ising-like spin-chain antiferromagnet $BaCo_2V_2O_8$. To demonstrate this, the team employed high-magnetic-field terahertz-spectroscopy techniques. They performed measurements in static magnetic fields up to 32 T using a Fourier-transform far-infrared spectrometer at the High Field Magnet Laboratory (HFML) in Nijmegen. The team also went to the Helmholtz-Zentrum Dresden-Rossendorf and did electron-spin-resonance experiments in pulsed magnetic fields up to 61 T at the Dresden High Magnetic Field Laboratory (HLD), employing an ELBE free electron laser as a tunable source of terahertz radiation.

The figure shows a peculiar frequency-field diagram of the observed magnetic excitations in $BaCo_2V_2O_8$. The experiments evidenced the presence of several modes, including ordinary single-magnon excitations (modes $M_{\pi/2}^{1}$, $M_{\pi/2}^{u}$, M_{π}^{1}, and M_{0}^{u}), as well as repulsively bound two-magnon (mode D_{π}, $D_{\pi/2}$) and repulsively bound three-magnon ($T_{\pi/2}$) excitations. By comparing these results of their terahertz-spectroscopy measurements to theoretical predictions for a Heisenberg–Ising (also known as XXZ) chain antiferromagnet the researchers can explain the occurrence of the multi-particle modes by repulsively bound magnon excitations. The experimental results show that these high-energy states, well separated from continua, exhibit notable dynamical responses and, despite dissipation, are sufficiently long lived to allow for an experimental observation.

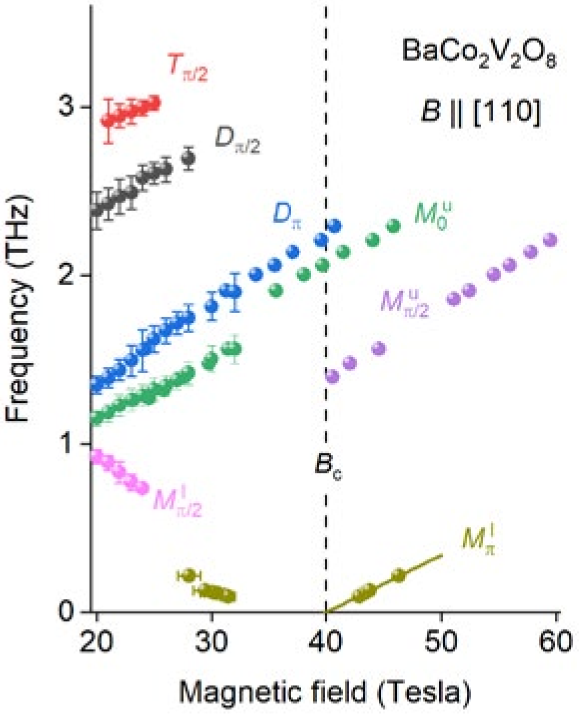

Figure: Frequency-field diagram of magnetic excitations in $BaCo_2V_2O_8$ in transverse magnetic fields. The experiment reveals the presence of single-magnon excitations (modes $M_{\pi/2}^{1}$, $M_{\pi/2}^{u}$, M_{π}^{1}, and M_{0}^{u}), as well as repulsively bound two- and three-magnon excitations (modes D_{π}, $D_{\pi/2}$, and $T_{\pi/2}$, respectively).

Experimental observation of repulsively bound magnons, Z. Wang, C.-M. Halati, J.-S. Bernier, A. Ponomaryov, D. I. Gorbunov, S. Niesen, O. Breunig, J. M. Klopf, S. Zvyagin, T. Lorenz, A. Loidl, and C. Kollath, Nature **631**, 760 (2024).

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OPENING OF THE 32ND CALL FOR ACCESS

On October 15, 2024, EMFL launched the 32nd call for proposals inviting researchers worldwide to apply for access to one of the research infrastructures 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. You may find the online form for these proposals on the EMFL website.

www.emfl.eu/user

In the frame of the EU-funded ISABEL project, EMFL will continue to trial the novel **dual-access** procedure. Furthermore, EMFL will further proceed with the **first-time access** mode, with the aim of lowering the barrier for researchers to start using the EMFL facilities. Prospective users are encouraged to contact a staff member of EMFL who will be happy to provide support in preparing the proposals.

There are three more recent access modes within ISABEL: The novel **fast-track access** mode is permanently open. A convincingly urgent scientific case may be addressed as request to the EMFL Board of Directors (BoD). The BoD will evaluate the request and decide within typically two weeks, but may optionally consult one or more EMFL Selection Committee members and check the feasibility with the facility manager and the local contact. Further, users may apply for **technical-development access**, dedicated to the interest of scientists wishing to develop and improve technical installations and metrological procedures that could also be of interest to other EMFL users. A tailored **long-term access** mode was set up in order to meet the demand for schemes such as complex high-level science cases, which require a sequel of high-field experiments. If positively evaluated, the user will obtain an extended amount of access over a two- to three-year period. Proposals to the latter two access modes must be submitted during the regular call periods and will be evaluated by the BoD as a special category.

Please note that each experiment carried out must be followed by a progress report and a 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 November 15, 2024.

The EMFL Selection Committee will evaluate the proposals. 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). We strongly recommend contacting 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 (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.

EMFL DAYS 2024 IN PRAGUE


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Every two years, the staff members from all four EMFL sites meet somewhere outside their facilities to exchange ideas, discuss best practices of administrative procedures, and strengthen the common EMFL spirit. This time, the sixth meeting of the EMFL Days took place in Prague from 16 to 18 September 2024.

Altogether, 110 EMFL staff members gathered in the capital city of the Czech Republic in a hotel near the center. Although the flooding in some parts of the country did prevent some people from participating, most EMFL staff arrived safely. For many participants, it was the first visit to Prague and they were able to enjoy the surrounding with a walk through the city in perfect weather conditions.

The EMFL Days started on Monday afternoon by a plenary session with an opening and welcome by Jochen Wosnitza (HLD). Further, Charles Simon (LNCMI), chair of the EMFL Board of Directors, updated on the EMFL status and future plans. The invited speaker Jan Prokleska, Vice-Head of Department of Condensed Matter Physics, Charles University and representing the Czech regional partner in the ISABEL project, presented the "MGML infrastructure in Prague". The directors of the three laboratories – Britta Redlich (HFML), Charles Simon, and Jochen Wosnitza (HLD) – presented the current state and future plans of their facilities. Further, Charles Simon and Xavier Chaud (LNCMI) gave overviews on the EU projects ISABEL and SuperEMFL, respectively. An informal evening program closed the day, when staff joined the entertaining and informative quiz prepared by students from HLD. Exchange of information and lively discussions started Tuesday morning during the two first sessions of workgroups. As usually, the workgroups covered the topics: i) Magnets and facilities development, ii) Instrumentation, iii) Administration/hosting users/communication, and iv) PhD/Post-Doc session. The afternoon, dedicated to an informal tour through the city of Prague, allowed enjoying the historic buildings, the bridges, and embankments. Finally, the participants joined for dinner at an authentic restaurant with typical Czech beer and food.

Wednesday morning, the groups continued their work during the two last sessions and defined their vision of a common strategy for EMFL. The morning ended with a wrap-up plenary meeting, during which the groups shared the outcome of the different sessions. Looking back, the EMFL Days are ideal for exchanging information between EMFL staff, whether to discuss the development of a project and its opportunities or to stimulate ideas by creating stronger bonds and intensified dialogue between staff as well as by getting to know each other better. Indeed, the very well organized EMFL Days 2024 have been a very successful and fruitful meeting.


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COOPERATION BETWEEN EMFL AND JAPANESE HIGH-MAGNETIC-FIELD LABS

Since many years, various fruitful collaborations and interactions exist between the Japanese high-magnetic-field community and EMFL. In an effort to consolidate formally these common interests, the High Magnetic Field Collaboratory and EMFL signed a Memorandum of Understanding (MoU).

The High Magnetic Field Collaboratory is a collaborative research organization consisting of the International MegaGauss Science Laboratory at the Institute for Solid State Physics (ISSP), University of Tokyo, the Center for Advanced High Magnetic Field Science, Graduate School of Science, Osaka University, and the High Field Laboratory for Superconducting Materials, Institute for Materials Research, Tohoku University. With the MoU, the partners strive to encourage visits of their staff members from one institution to the other, strengthen their cooperation, exchange scientific information, and promote the use of the partner facilities in their respective scientific communities.

In this context, we would like to point out to our user community that in the frame of the High Magnetic Field Collaboratory it is possible to carry out experiments at extremely high magnetic fields, beyond 200 T. To reach such extreme magnetic fields comes with the drawback of being fully destructive, but can lead to very valuable scientific knowledge. For now, ISSP is the only place worldwide that offers such fields together with sophisticated experimental infrastructure.
For further information, please visit: **https://hf-colabo.jp/en/**

EMFL SPRING SCHOOL 2024

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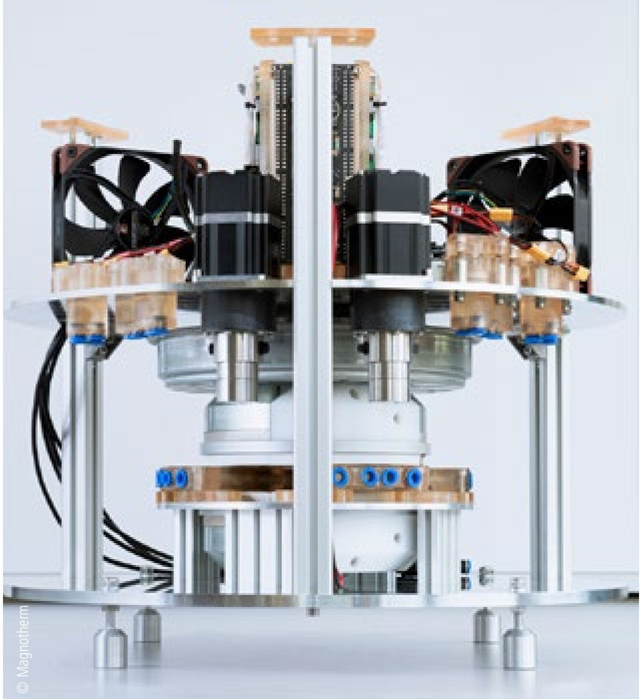
Following a two-year interval, we revived the tradition of EMFL Schools to motivate and inspire the next generation of high-magnetic-field researchers in Europe. This event took place in the Penck Hotel, a modern-art venue nestled in the historic neighborhood of Dresden, Germany, from April 15-19, 2024.

The 2024 program focused on both fundamental and applied aspects of materials research. Renowned speakers covered a wide range of topics including low-dimensional semiconductors, topological matter, strongly correlated electron systems, magnetism, superconductivity, and high-magnetic-field technology. Additionally, the school's agenda featured a variety of interactive elements: a pitch session, during which each participant had two minutes to showcase their posters; a poster session for more detailed discussions; a fireside chat that delved into the personal aspects of a scientific career; and a group activity that honed participants' skills in scientific storytelling.

The event attracted significant interest, with 59 applicants out of 66 applications accepted. Ultimately, 52 participants from 17 different countries actually attended the event. This week-long inspiring experience sparked the interest of the newcomers in high-magnetic-field research and, for the others, provided the tools and knowledge needed to advance their research in the realm of high magnetic fields.

MAGNOTHERM



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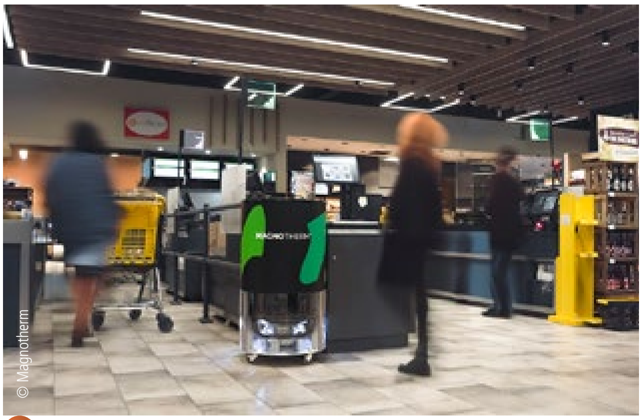
› The first commercial magnetic refrigerator

Founded in 2019, MAGNOTHERM is a startup company headquartered in Darmstadt, near Frankfurt. Our international team of over 40 experts has world-leading expertise in magnetic cooling and magnetocaloric materials.

MAGNOTHERM aims to make a significant contribution to reversing the climate crisis and revolutionizing the cooling industry, which currently is responsible for at least 7 % of global CO_2 equivalent emissions. Our technology allows cooling and heating with low pressure and is up to 30 % more energy efficient than current gas-compression systems, whilst being non-explosive, non-flammable, and easy to maintain. We develop our clean cooling technology for the commercial market in Europe and beyond. Our aim is to meet the rapidly growing global demand for cost-efficient and sustainable cooling applications and offer a path forward for policy makers to help transition away from gas-compression cooling, a technology which has not changed for more than a century.

Magnetocaloric materials are at the heart of our technology. By exposing these materials to magnetic fields and magnetizing them, the material is instantly heated. This heat is dispersed using a water-based cooling fluid. The material is then demagnetized, reducing its temperature. The material cools down a fluid, which is then pumped through the cooling application to reach the desired temperature. The process is repeated to maintain the temperature in the required range of cooling.

Since 2023, MAGNOTHERM and the Dresden High Magnetic Field Laboratory use their strengths synergistically with the common aim of building Europe's first magnetocaloric hydrogen liquefier to demonstrate the feasibility of hydrogen liquefaction on an industrial scale.



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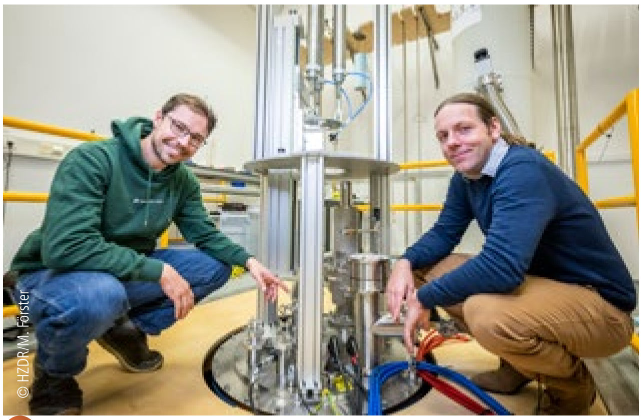
› POLARIS in the supermarket



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› Thomas Platte and Tino Gottschall presenting the demonstrator at HZDR

UPCOMING EVENTS

1 16th Joint Conference on Magnetism and Magnetic Materials and Intermag, New Orleans, USA, January 13-17, 2025
https://2025-joint.magnetism.org/

2 DPG Spring Meeting of the Condensed Matter Section, Regensburg, Germany, March 16-21, 2025.
https://regensburg25.dpg-tagungen.de/

3 Joint March Meeting and April Meeting (APS Global Physics Summit), Anaheim, USA, March 16-21, 2025.
https://summit.aps.org/

4 13th International Conference on Highly Frustrated Magnetism, Toronto, Canada, May 25-30, 2025.
https://conference.physics.utoronto.ca/event/18/

5 International Conference on Magnet Technology (MT29), Boston, USA, July 1-6, 2025.
https://mt29-conf.org/

6 International Conference on Strongly Correlated Electron Systems (SCES 2025), Montréal, Canada, July 6-11, 2025.
https://sces2025.org/

7 30th International Conference on Low Temperature Physics (LT30), Bilbao, Spain, August 7-13, 2025.
https://www.lt30.es/

8 Joint European Magnetic Symposia (JEMS), Frankfurt, Germany, August 24–29, 2025.
https://magnetism.eu/264-jems2025.htm

9 17th European Conference on Applied Superconductivity, Porto, Portugal, September 21-25, 2025.
https://eucas2025.esas.org/


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› Casa da Música, Porto

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