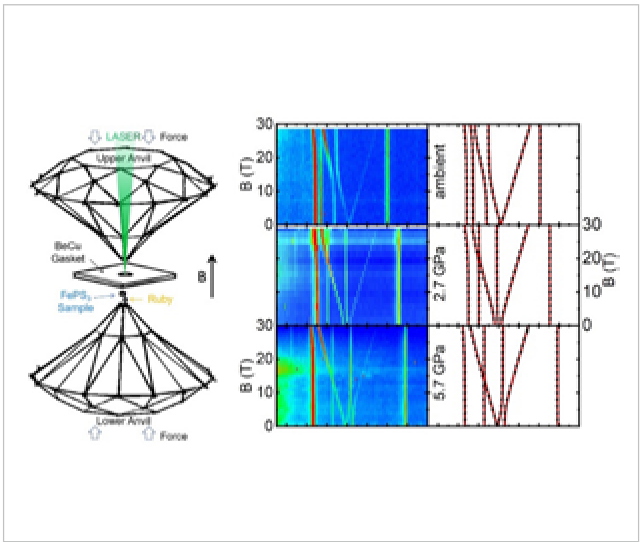
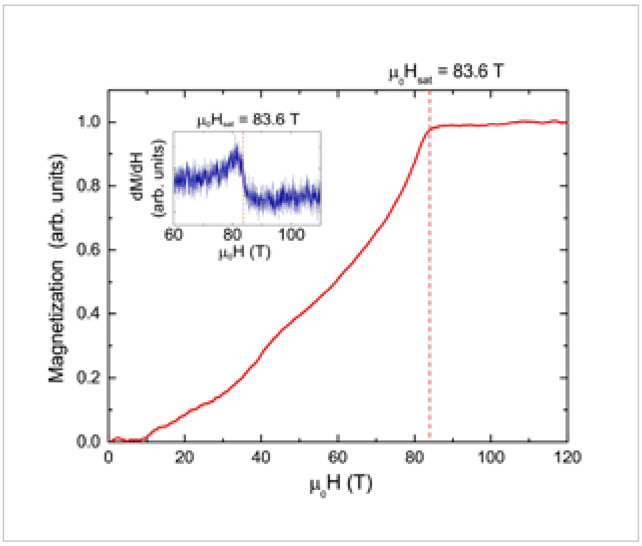
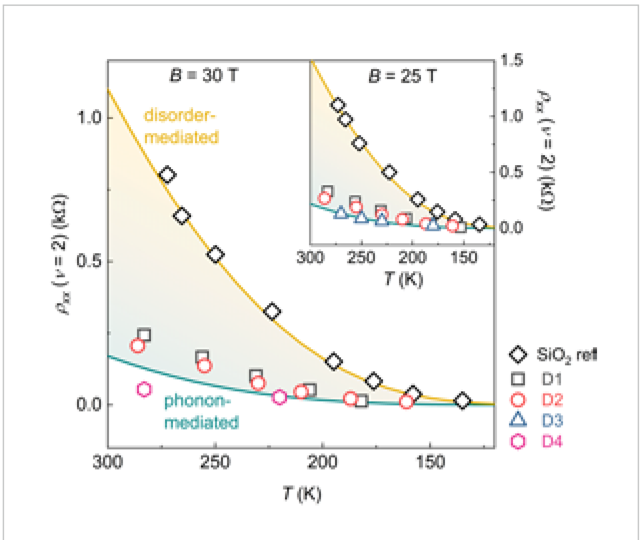
European Magnetic Field Laboratory

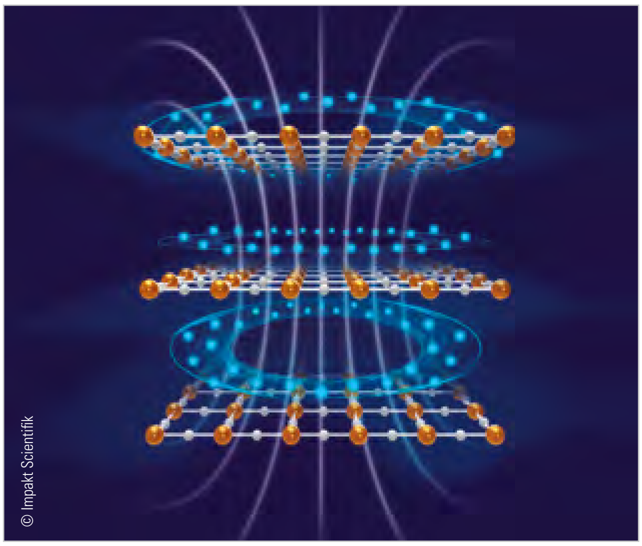
EMFLNEWS

N°4 2022









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DEAR READER

The chairperson of EMFL is changing by rotation every two years and I am very proud to take over this role for 2023 and 2024. I take this opportunity to thank Peter Christianen for the excellent work he did during the two past years as chairman of EMFL.

This EMFLNews will give you a new opportunity to follow what EMFL has done the last three months. Thanks to the European program ISABEL, EMFL is changing continuously and we recently have introduced new access modes to the benefit of our users. More details can be found on our website - please have a look and take your time to discover these new opportunities.

This year, the user meeting will be organized mid-June in Nijmegen. It will be open to everyone, as usual. Please follow the announcements to register and participate. The EMFL prize winner will be announced at this occasion. The user survey for the preparation of the roadmap for the development of new magnets over the next decade has recently started. Please take the time to contribute.

I wish you a very pleasant year 2023,

Charles Simon
Director LNCMI
Chairman EMFL

MEET OUR PEOPLE

Femke Tabak, HFML-FELIX

Since October 2022, I have joined HFML-FELIX as managing director of the institute. For me this means a return to physics: I started my career at the University of Leiden, where I studied surface science and the development of high-speed scanning probe microscopy during my PhD. After my PhD, I took the opportunity to work at a start-up company making graphene for industrial applications.

In 2018, I transitioned from doing scientific research myself to research policy and research funding. I have worked for five years at the Dutch Research Council, mainly involved in public-private collaborations and policy development for all fields of science. I am driven by a motivation to combine policy with execution, to develop a strategy on a subject and then make it work. At HFML-FELIX, I am responsible for the management of the office and the operational affairs, and with the Scientific Directors I work on the funding strategy and internal organization.

In my free time, I'm enjoying nature around the village where I live, sometimes with my children, other times training for the occasional cross-triathlon that I like to do.

For the future, I am looking forward to joining and further developing the collaboration with EMFL.

Femke Tabak

PREDOMINANCE OF ELECTRON-PHONON SCATTERING IN THE ROOM-TEMPERATURE QUANTUM HALL EFFECT IN GRAPHENE

Uli Zeitler, Steffen Wiedmann, HFML Nijmegen and Sergio Pezzini, Istituto Nanoscienze-CNR Pisa

The quantum Hall effect (QHE), a paradigmatic phenomenon of two-dimensional (2D) electron systems in high magnetic fields, typically occurs only at very low temperatures of a few kelvin. Under these conditions, lattice vibrations (so-called phonons) are suppressed and, thus, play a marginal role in the electrical transport. Graphene, the purely 2D form of carbon, stands out from its 2D peers due to a giant energy gap between its first two Landau levels (LLs), which enables the observation of quantum Hall states up to room temperature (RT, ~300 K).

Indeed, already more than 15 years ago, high magnetic fields crucially contributed to the first observation of this RT-QHE in graphene. However, only samples resting on SiO_2 had been studied in this regime, potentially missing out intrinsic physics due to detrimental substrate-induced disorder.

Now, a team of researchers from the Istituto Nanoscienze-CNR Pisa, the University of Salamanca, RWTH Aachen University, the Radboud University and HFML Nijmegen have investigated a collection of high-quality graphene samples encapsulated in hexagonal boron nitride (hBN, provided by researchers at NIMS). In zero field, the RT conductivity of these van der Waals sandwiches is known to be chiefly limited by electron-phonon scattering. What happens if one applies a magnetic field strong enough to realize the RT-QHE?

Bearing this question in mind, the team made use of the HFML-EMFL facility to measure the so-called thermally activated resistivity, with the devices set to filling factor 2 where the most pronounced quantum Hall plateaus develops. As the temperature is increased toward RT, mobile charge carriers are excited across the LL gap. The consequent exponential increase in the resistivity directly relates to the gap size, as well as to the underlying carrier scattering mechanism.

Phonon-mediated room-temperature quantum Hall transport in graphene, D. Vaquero, V. Clericò, M. Schmitz, J. A. Delgado-Notario, A. Martín-Ramos, J. Salvador-Sánchez, C. S. A. Müller, K. Rubi, K. Watanabe, T. Taniguchi, B. Beschoten, C. Stampfer, E. Diez, M. I. Katsnelson, U. Zeitler, S. Wiedmann, and S. Pezzini, Nat. Commun. **14**, 318 (2023).

Despite their LL gap being equal, the activated resistivity of the graphene-hBN devices turned out to be strikingly lower with respect to that of disordered reference samples. On the one hand, graphene on SiO_2 could be described by parameters associated to long-range disorder, not differently from the standard low-temperature QHE. On the other hand, the new data strikingly follows a recent theoretical model by Alexeev et al., in which the temperature and field-dependent activated conductivity is ascribed to two-phonon-electron scattering alone. Thanks to the data collected over several high-field runs, the researchers were able to reproduce this phenomenon in different samples, whilst finding a correlation between deviations from the RT-QHE phonon-limit and their zero-field charge-carrier mobility.

The observation of phonon-mediated quantum-Hall transport marks yet another unique property of graphene, underlying the central role of van der Waals technology for the study of transport phenomena in 2D.

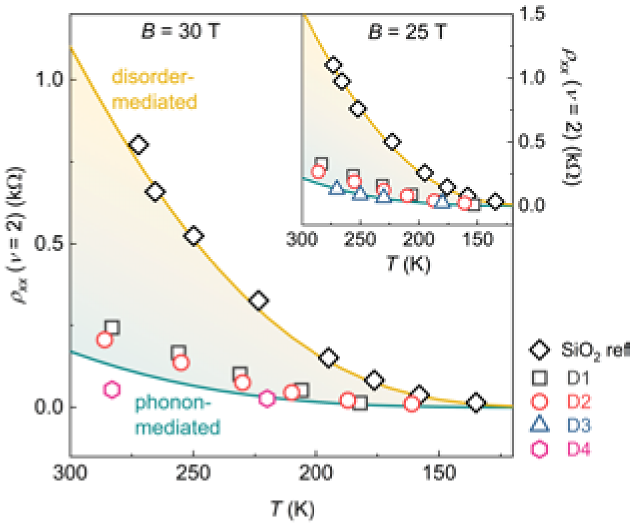

Figure: Thermally activated resistivity at ν = 2 in different hBN-encapsulated graphene devices (D1-D4), measured at B = 30 T (main panel) and 25 T (inset). The dark cyan and yellow solid lines are calculated curves, defining two different dissipation limits in the QH phase.

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HIGH-PRESSURE TUNING OF MAGNON-POLARONS IN THE LAYERED ANTIFERROMAGNET $FePS_3$

Amit Pawbake and Clément Faugeras, LNCMI Grenoble

Spin waves (magnons) in magnetically ordered solids – ferromagnets or antiferromagnets – are collective excitations of an ensemble of spins. They propagate in the solid and do couple to phonons of the host material to create new quasiparticles named magnon-polarons. This coupling is of prime importance as it defines the properties of magnons, which are at the heart of spintronics.

This coupling and the resonant nature of the magnon-phonon interaction is best evidenced when the energies of the two excitations are in resonance. In the case of antiferromagnetic materials, this specific condition can be achieved by tuning the magnon energy with an external magnetic field. The magnon double degeneracy is then lifted and one of the two magnon components has an energy that increases with the external magnetic field due to the Zeeman contribution, allowing to explore the higher energy range, while the other component has an energy that decreases with magnetic field.

In this work, we use high-pressure environments to tune the phonon spectrum through the magnon to observe a new case of magnon-polarons for which the created quasiparticle involves a phonon and a doubly degenerate antiferromagnetic magnon. In bulk $FePS_3$, a layered antiferromagnet, we show that the magnon energy does not depend, in first approximation, on the applied hydrostatic pressure. We understand this surprising behavior as resulting from the strong in-plane magnetic exchange constant with respect to the interlayer one. The in-plane degrees of freedom of this layered magnetic system appear to be very weakly altered by the external pressure, while phonons are very sensitive to any deformation and are efficiently tuned through the magnon excitations.

At a pressure of 3 GPa, we reach the resonance condition and we observe a strong avoided crossing involving three modes. The character of these different modes can be determined by applying an external magnetic field, which disentangles the hybrid excitations by tuning the magnon energy. These results are presented in the Figure in the form of false-color plots of the magneto-Raman scattering response for different pressures for which the P3 phonon has an energy below, in resonance with, and above the magnon energy.

Combining different extreme environments opens new possibilities in solid-state physics and allows exploring the properties of electronic and magnetic systems in an original way, providing new information and insights into the phase diagram and the physics of such systems.

High-Pressure Tuning of Magnon-Polarons in the Layered Antiferromagnet $FePS_3$, A. Pawbake, T. Pelini, A. Delhomme, D. Romanin, D. Vaclavkova, G. Martinez, M. Calandra, M.-A. Measson, M. Veis, M. Potemski, M. Orlita, and C. Faugeras, ACS Nano **16**, 12656 (2022).

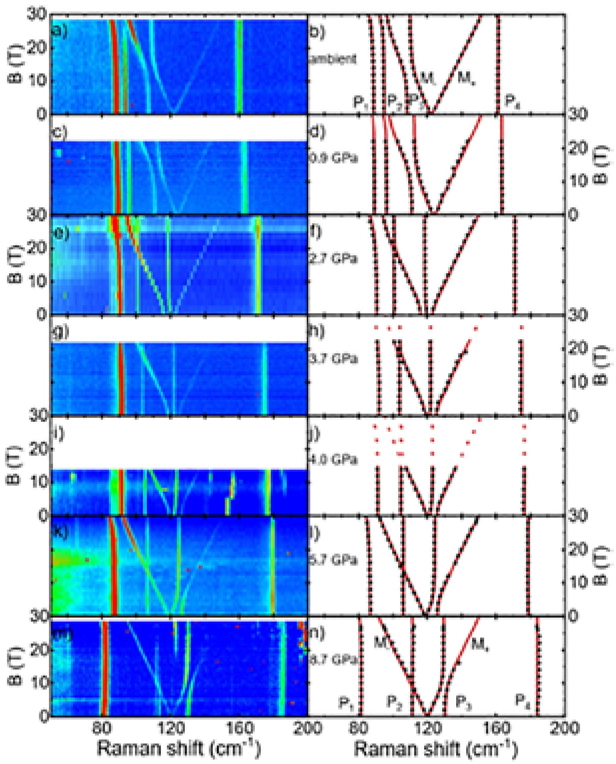

Figure: (a-n) Left: false-color map of the low-temperature magneto-Raman scattering response of bulk $FePS_3$ at selected applied pressures showing the evolution of magnon-polarons for various magnon-phonon energy detuning. Right: Evolution of the energies of the excitations observed in the Raman scattering response with magnetic field (black dots) and results of our model (red solid lines) allowing us to extract the evolution of the coupling parameters.

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INFLUENCE OF HIGH MAGNETIC FIELDS ON ELECTRONS UNDERGOING PLANCKIAN DISSIPATION

Amirreza Ataei and Louis Taillefer, Université de Sherbrooke, Canada, Cyril Proust and David Vignolles, LNCMI-Toulouse

In certain materials called "strange metals", the electrical resistivity follows a perfectly linear temperature dependence at low temperature, in contrast to the standard quadratic dependence expected from standard Fermi-liquid theory. Remarkably, it has recently been shown that electrons in these strange metals undergo collisions with each other at a rate which is set by Planck's constant. This intriguing phenomenon, dubbed "Planckian dissipation", appears to be a universal property of strange metals, and it remains a fundamental puzzle.

The question we asked ourselves is this: how are electrons undergoing Planckian dissipation influenced by a magnetic field B? Recent experiments on strange metals revealed that the electrical resistivity exhibits a B-linear dependence at low temperature, in contrast to the standard quadratic dependence expected of conventional metals. Is this anomalous B-linear resistivity another facet of Planckian dissipation?

We carried out a series of high-field experiments at the LNCMI in Toulouse to measure the field dependence of the resistivity, or magnetoresistance (MR), of two cuprate superconductors – Nd-LSCO and LSCO – at a hole doping (p = 0.24) such that their electronic state is in the strange-metal regime. The experiments were mostly done in a configuration where the magnetic field is applied normal to the copper-oxide planes of the material (see Figure 1).

We observed a B-linear dependence at low temperature, which evolves into a B-quadratic dependence at high temperature, as displayed in Figure 2a for Nd-LSCO. We then calculated the MR expected from conventional Boltzmann transport theory given the scattering rate that was previously measured for Nd-LSCO at p = 0.24 in a recent study of the angle-dependent magnetoresistance (ADMR). The results of this calculation are shown in Figure 2b. We see that the calculations reproduce well and quantitatively the measured MR. We find that the origin of the B-linear MR in Nd-LSCO and LSCO is linked to a strong in-plane anisotropy of the elastic scattering rate.

We conclude that Planckian dissipation is anomalous in its temperature dependence, but not in its field dependence and the scattering rate does not have a magnetic-field dependence. We hope that our work contributes to a better understanding of Planckian dissipation.

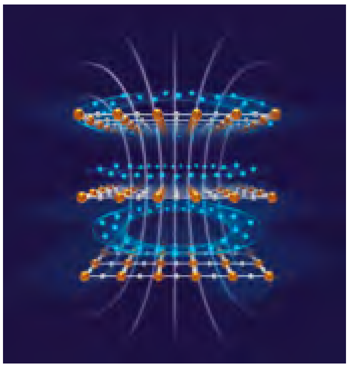

Figure 1: Sketch of electrons (cyan) moving in orbits within the copper-oxide planes of a cuprate material (Cu atoms in bronze, O atoms in silver) when a magnetic field is applied normal to the planes. *Credit:* Impakt Scientifik.

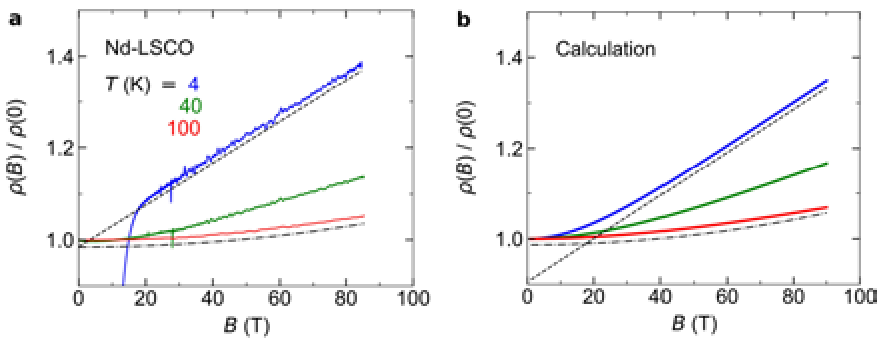

Figure 2: Measured and calculated magnetoresistance (MR) in the cuprate superconductor Nd-LSCO at a hole doping p = 0.24, plotted as ρ(B)/ρ(0) vs B, for J || a and B || c, at various fixed temperatures, as indicated. (a) Isotherms measured up to 85 T, for T = 4 K (blue), 40 K (green), and 100 K (red). The MR at 4 K is seen to be linear in field above ~about 40 T, whereas the MR at 100 K is quadratic, as emphasized by the linear (dashed) and quadratic (dashed dotted) lines. (b) Calculated MR using the parameters for Nd-LSCO extracted from a prior ADMR study (Grissonnanche et al., Nature 595, 667 [2021]), for the same three temperatures.

Electrons with Planckian scattering obey standard orbital motion in a magnetic field, A. Ataei, A. Gourgout, G. Grissonnanche, L. Chen, J. Baglo, M-E. Boulanger, F. Laliberté, S. Badoux, N. Doiron-Leyraud, V. Oliviero, S. Benhabib, D. Vignolles, J.-S. Zhou, S. Ono, H. Takagi, C. Proust, and L. Taillefer, Nat. Phys. **18**, 1420 (2022).

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DIMENSIONAL REDUCTION AND INCOMMENSURATE DYNAMIC CORRELATIONS IN A TRIANGULAR-LATTICE ANTIFERROMAGNET

Sergei Zvyagin, HLD Dresden

Antiferromagnetic materials with spin 1/2 and triangular-lattice structures are in the focus of modern quantum physics, in particular, in connection with Anderson's idea of "resonating valence bond" states in frustrated spin systems. He proposed that the ground state could be a two-dimensional (2D) fluid of resonating spin-singlet pairs, with the elementary excitation spectrum formed by fractionalized mobile quasiparticles, so-called spinons. On the other hand, in spite of the 2D structure, magnetic correlations in such materials can have a pure 1D character, with the excitation spectrum also formed by spinons. This phenomenon is known as frustration-induced dimensional reduction. This was first observed in the triangular-lattice antiferromagnet Cs_2CuCl_4. Investigating the spin dynamics and ground-state properties of such systems is of prime interest in frustrated magnetism, both from experimental and theoretical points of view.

$Ca_3ReO_5Cl_2$ (CROC hereafter) is the second material, where a frustration-induced dimensional reduction was revealed. We performed high-field electron spin resonance (ESR) spectroscopy and magnetization studies, allowing us not only to refine the spin-Hamiltonian parameters, but also to investigate peculiarities of the spin dynamics and magnetic properties in a broad range of frequencies and fields, relevant to the energy scale of magnetic interactions in this new frustrated spin system.

Based on our ESR results and model calculations for a triangular-lattice antiferromagnet with reduced dimensionality (Figure 1), we conclude that the presence of uniform Dzyaloshinskii-Moriya interaction (DMI) shifts the spinon continuum in momentum space. As a result, a zero-field gap opens that we observed directly.

Pulsed-field magnetization measurements of CROC powder up to 120 T revealed a saturation field of 83.6 T (Figure 2). We used this value to calculate the interchain exchange interaction.

Based on our observations, we suggest that a pure DMI-spiral state can be realized in CROC, making this material an attractive toy model to explore details of the dimensional reduction and other effects of the geometrical frustration in low-dimensional spin systems with competing interactions. This work was done in collaboration between the HLD and the Institute for Solid State Physics, University of Tokyo.

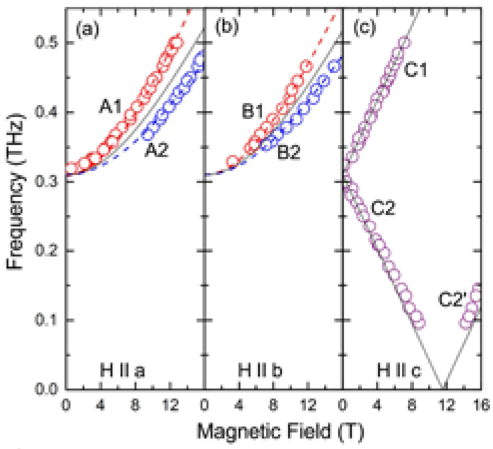

Figure 1: Frequency-field diagrams of magnetic excitations at 2 K in CROC with fields applied along the (a) a, (b) b, and (c) c axis. The solid lines are results of model calculations for a triangular-lattice antiferromagnet with reduced dimensionality and uniform DMI.

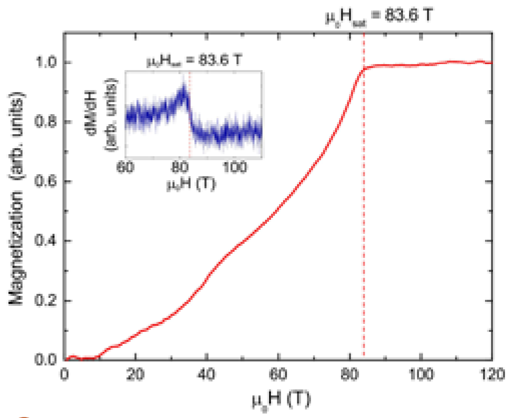

Figure 2: Magnetization of a CROC powder sample in magnetic fields up to 120 T, obtained using a pulsed single-turn magnet (initial temperature is 5 K). The inset shows the derivative of the as-measured magnetization M.

Dimensional reduction and incommensurate dynamic correlations in the S = 1/2 triangular-lattice antiferromagnet $Ca_3ReO_5Cl_2$,
S. A. Zvyagin, A. N. Ponomaryov, J. Wosnitza, D. Hirai, Z. Hiroi, M. Gen, Y. Kohama, A. Matsuo, Y. H. Matsuda, and K. Kindo, Nat. Commun. **13**, 6310 (2022).

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RESULTS OF THE TWENTY-EIGHTH CALL FOR ACCESS

On 15 November 2022, the 28th call for access to the EMFL facilities ended. After that, the Selection Committee ranked the proposals on a competitive basis.

Our four facilities

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

are open to users worldwide. EMFL operates a joint transnational access program, which grants full access to these installations and all associated scientific infrastructure to qualified external users, supplemented by the necessary support from the scientific and technical staff on site.

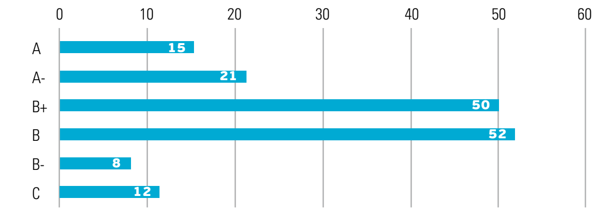
For this 28th call, 158 applications were submitted, of which 3 are proposals for dual access with regional partner laboratories, 2 for long-term access, 3 for fast-track access, and 19 proposals for first-time access to the EMFL high-field facilities. These novel access procedures are defined in the EMFL-ISABEL project. Long-term, fast-track and combined access modes were introduced at this call.

The proposals came from 23 different countries and were evaluated by the EMFL Selection Committee until 15 December 2022. The Selection Committee consists of 18 specialists covering the following five scientific topics:

- Metals and Superconductors (46 applications),
- Magnetism (65 applications),
- Semiconductors (35 applications),
- Soft Matter and Magnetoscience (5 applications),
- Applied Superconductivity (7 applications).

Besides of ranking the proposals, the committee members decide on the number of accepted magnet hours and number of pulses.

NEXT CALL :
Launch: April 15, 2023
Deadline: May 15, 2023

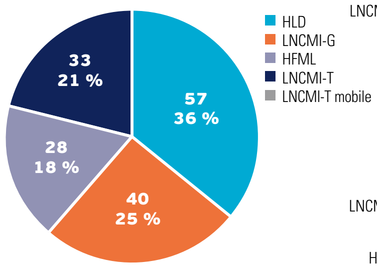


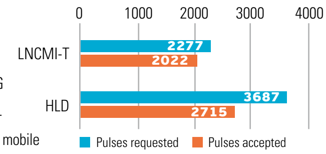
Evaluation of applications

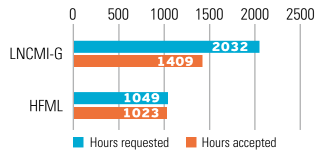
The proposals are ranked in three classes:
A (excellent proposal to be carried out),
B (should be performed but each facility has some freedom considering other constraints),
C (poorly crafted proposal, or one that does not need any of the four unique high-magnetic-field laboratories).

In the B category, the ranking + or - serves as a recommendation to the facility. This degree of freedom is necessary to allow the facilities to consider other aspects such as available capacity and equipment necessary for the successful outcome of a project.

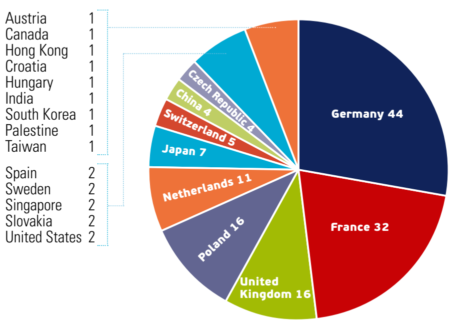
Distribution by facilities
Number of applications







Distribution by country of PI affiliation



WORKSHOP ON 2D MATERIALS

As part of the ISABEL project, the University of Warsaw hosted a workshop on two-dimensional (2D) materials from 24 to 26 October, 2022. After two years of mainly virtual training activities, this in-person event was a unique opportunity to meet researchers who are leading studies in the field of materials research. The diverse program included talks on van der Waals materials and heterostructures with a special emphasis on magnetic layered materials, which have recently drawn the attention of researchers. The workshop was attended by nearly 100 participants and included talks by 29 invited speakers from 7 European countries. There were as well 18 posters on display presented by young researchers from Poland. For the full list of invited speakers, please see: http://2dmaterials.fuw.edu.pl/.

The workshop provided an update on research conducted in Europe on 2D materials including the recent advancement of groups studying their properties in high magnetic fields. The workshop was an opportunity for the Polish community of high magnetic field users involved in studies of 2D materials to exchange their experiences and present their scientific results. In particular, it was possible to learn about the results of recent experiments done at the Faculty of Physics at the University of Warsaw within the new scheme of "double access" at the European Magnetic Field Laboratory (EMFL) facilities.

The workshop was also a major event of the "2D Materials" International Research Project supported by CNRS, which combines the efforts of the National High Magnetic Field Laboratory in Grenoble (France), the Institut Europeen des Membranes in Montpellier (France), the University of Warsaw (Poland), and Wrocław University of Science and Technology (Poland). The lectures presented by the participants summarized the current status of Polish-French partnerships and revealed new avenues of scientific collaboration.

Finally, we are pleased to acknowledge that the workshop was supported by the European Union (ISABEL-project no 871106) and the Ministry of Education and Science in Poland (grant no. DIR/WK/2018/07) that also supports the Polish participation in the EMFL.

Professor Antonio Polimeni of Sapienza University of Rome presenting the opening lecture of the workshop.

BILFINGER NOELL GMBH

Bilfinger Noell GmbH is a company of Bilfinger SE, operating worldwide in the product areas of nuclear service, nuclear technology, and magnet technology.

In close cooperation with customers, Bilfinger Noell develops and fabricates LTS and HTS superconducting magnet systems for research and industry. This includes individual solutions in vacuum and cryotechnology such as large test facilities for superconducting magnets.

Bilfinger Noell has supplied superconducting magnets for large-scale projects such as FAIR, CERN, and the fusion experiment Wendelstein 7-X. For these customers, we started with the development of prototypes and continued with the series fabrication of the magnets.

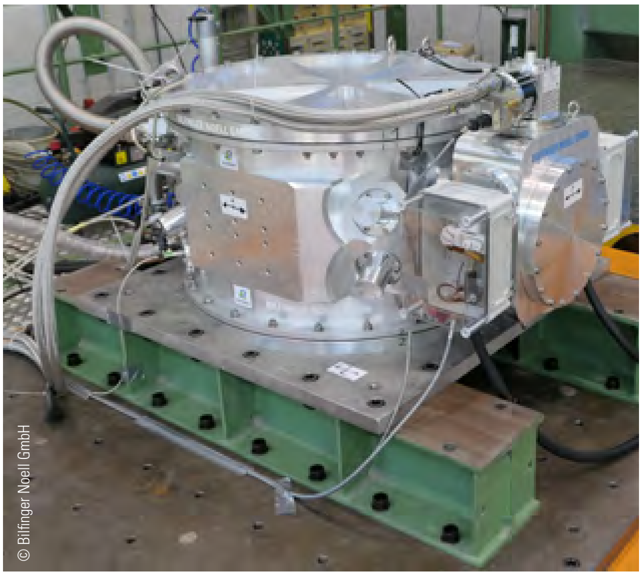
In cooperation with the Karlsruhe Institute of Technology, we developed superconducting undulators and wigglers and brought them to market. Bilfinger Noell delivered recent devices to BNL and ANSTO. For the PUMA (antiProton Unstable antiMatter Annihilation) experiment, Bilfinger Noell built a custom-made magnet, capable of being transported on a truck at full field to move antimatter between experiments.

Bilfinger Noell designed and built an HTS Solenoid for the application in extremely harsh environments, which was mechanically tested in operation with 14 g acceleration in horizontal and vertical direction. With EMFL, Bilfinger Noell is involved in the European H2020 projects EU ISABEL and SuperEMFL.

www.noell.bilfinger.com

Magnet system for PUMA

HTS coils with 2nd generation YBCO conductor



Robust HTS solenoid tested with acceleration of 16 g

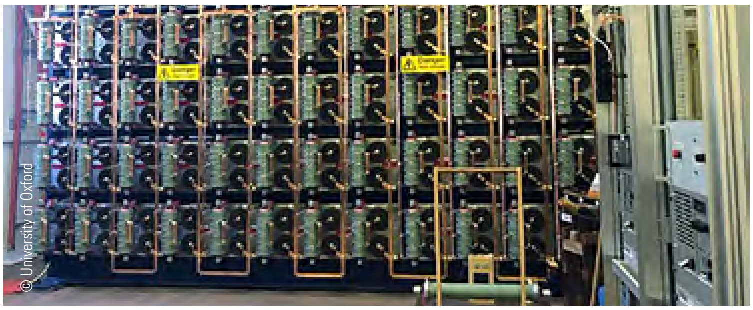
UNIVERSITY OF OXFORD, PHYSICS DEPARTMENT, OXFORD CENTRE FOR APPLIED SUPERCONDUCTIVITY

Oxford University has a long tradition in high magnetic field research hosting a large suite of magnetic fields and facilities above 50 T, which are the largest in the UK. The Oxford Centre for Applied Superconductivity (CFAS) was created in 2017 based on an investment by the Local Growth Funding as well as by the University of Oxford and local industrial partners working on superconductivity, which includes Oxford Instruments and Siemens. The Centre is a superconductivity hub with interests in future applications of superconducting materials which aims to pursue projects that can lead to future technologies and lead to the discovery of novel superconducting materials. The Centre helps to train people with necessary skills in superconductivity which can be transferable to other relevant industries.

The Oxford CFAS runs as a small research facility and has been hosting many users since 2017. The Physics department has its own helium liquefier and hosts multiple research labs fitted with superconducting magnets up to 21 T and low-temperature cryostats. These systems are mainly used for the studies of quantum materials, including superconducting materials, frustrated magnets, topological materials. One of the measurement systems is a Quantum Design 16 T magnet with a variable-range cryostat (2 – 350 K). This measurement system has a large suite of experimental techniques from magnetization, transport, and torque to thermal transport. The laboratory has developed additional techniques for low-noise transport measurements in single crystals and thin-flake devices under different experimental conditions, such as applied strain and applied pressure. The laboratory can perform experiments under strain using piezostacks and Razorbill and under pressure using piston cells up to 30 kbar and diamond anvil cells for pressures higher than 60 kbar. Another laboratory is used for critical-current studies in superconducting wires and tapes up to 500 A at 4.2 K and magnetic fields up to 14 T. The laboratories contain also a preparation room with high-resolution microscopes for sample preparation and pressure-cell tools.

The users of these facilities normally book the system to perform experiments using different techniques for one week. Each user is expected to prepare their own samples independently and training on the operation of the instrument is provided. The facility has the support of a technician for cryogenic issues and high critical current studies.

Oxford University also hosts the Nicholas Kurti Oxford Pulsed Field Laboratory. This is a local pulsed-field facility, which can operate three experimental magnet cells, which are powered by a configurable capacitor bank with maximum energy storage up to 3 MJ. Pulsed magnets are designed and wound in-house and have achieved fields above 50 T. Pulse lengths of the order of 10 ms can be adjusted by changing the configuration of the capacitor bank. Repetition times are less than one hour for full-field pulses. Non-standard and custom-made magnets are also available with longer pulse lengths, but typically at the cost of peak field. This installation has recently upgraded the capacitor bank and it is in an advanced testing phase. For further details, please contact Amalia Coldea (CFAS, www.cfas.ox.ac.uk) or Stephen Blundell (pulsed fields, www.physics.ox.ac.uk/about-us/our-facilities-and-services/nicholas-kurti-high-magnetic-field-laboratory).



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UPCOMING EVENTS

1 APS March Meeting, Las Vegas, USA, March 5-10, 2023.
https://march.aps.org

2 DPG Spring Meeting of the Condensed Matter Section, Dresden, Germany, March 26-31, 2023.
https://skm23.dpg-tagungen.de

3 Superconductivity Gordon Research Conference: Interactions, Topology and Applications, Les Diablerets, Switzerland, April 30 – May 5, 2023.
https://www.grc.org/superconductivity-conference/2023/

4 International Conference on Strongly Correlated Electron Systems (SCES 2023), Incheon, Korea, July 2-7, 2023.
https://www.sces2023.org

5 Joint European Magnetic Symposia (JEMS), Madrid, Spain, August 27 – September 1, 2023.
https://magnetism.eu/232-jems2023.htm

6 International Conference on Magnet Technology (MT-28), Aix-en-Provence, France, September 10-15, 2023.
https://mt28.aoscongres.com

7 Magnetic Resonance of Correlated Electron Materials, Dresden, Germany, September 17-23, 2023.
https://www.ifw-dresden.de/ifw-institutes/iff/events/international-conference-on-magnetic-resonance-of-correlated-electron-materials

8 International Conference on Magnetism (ICM2024), Bologna, Italy, June 30 - July 5, 2024.
https://www.icm2024.org

Palazzo Re Enzo und the Basilica of San Petron, Bologna

ANNOUNCEMENT

The 25th International Conference on the Electronic Properties of Two-Dimensional Systems (EP2DS-25) and the 21st International Conference on Modulated Semiconductor Structures (MSS-21) will be held in Grenoble, France, from 10 to 14th July 2023.

Information available here:
https://ep2ds25mss21.sciencesconf.org

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