EMFL
Annual
Report
2019

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European Magnetic Field Laboratory

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European Magnetic Field Laboratory

Annual report 2019

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Mounting sample © Gideon Laureijs, Radboud University)

Foreword

Dear Reader,

In this fifth annual report of the European Magnetic Field Laboratory, we are happy to report once more a number of excellent scientific highlights and important technical developments.

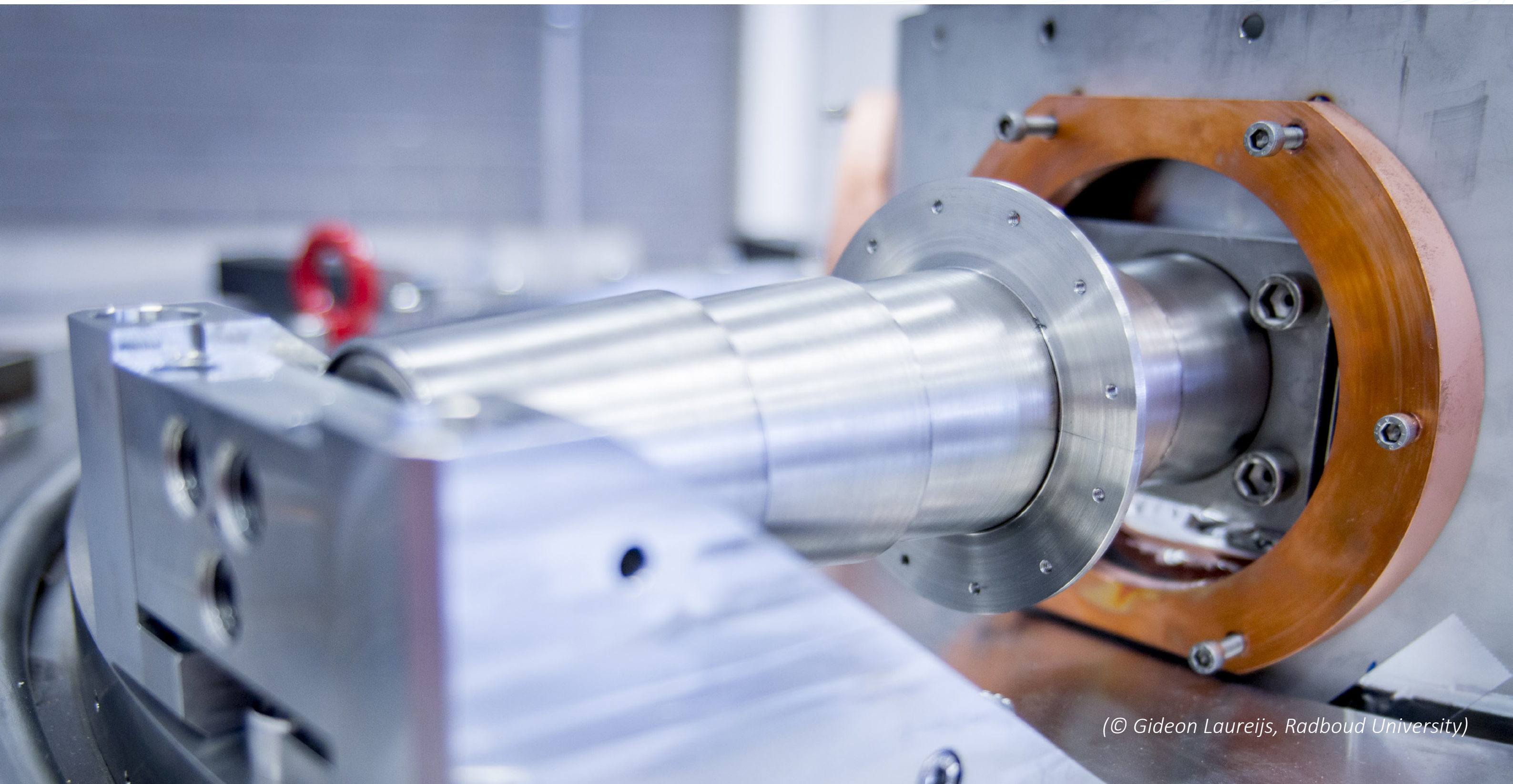
EMFL has continued to grow as two new members have joined us officially in 2019; the University of Warsaw on behalf of a consortium of Polish universities, and the French CEA, on January 1st and December 1st respectively. We welcome our new partners, and continue to work on increasing the EMFL membership even further.

In 2019, the request for magnet time has increased once more to a new record number of 388 proposals. This increasing demand shows the need for the sophisticated high-magnetic-field infrastructure provided by EMFL. The research performed in our facilities has resulted in more than 170 peer-reviewed publications, many of which appeared in highly ranked journals and 13 PhD students defended the results obtained in our installations for their thesis.

Finally, I would like to use this opportunity to thank all our staff and users of the EMFL facilities for making EMFL a great place to do science.

Geert Rikken

Chairman EMFL
Director LNCMI



(© Gideon Laureijs, Radboud University)

Mission

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

High magnetic fields are one of the most powerful tools available to scientists for the study, the modification and the control of the state of matter.

The European Magnetic Field Laboratory (EMFL) was founded in 2015 and awarded the Landmark status in March 2016 during the ESFRI Roadmap presentation in Amsterdam. EMFL provides the highest possible fields (both continuous and pulsed) for its researchers. The EMFL is dedicated to unite, coordinate and reinforce the four existing European high magnetic field facilities – the Dresden High Magnetic Field Laboratory (Germany), the Laboratoire National des Champs Magnétiques Intenses in Grenoble and Toulouse (France), and the High Field Magnet Laboratory in Nijmegen (The Netherlands) – within a single body as a world-leading infrastructure.

The missions of the EMFL are:

- to develop, construct and operate world-class high-field magnets
- to perform excellent research in very high magnetic fields
- to act as a European user facility for the scientists of the participating countries and for other scientists
- to act as the European centre of excellence for different magnetic-field-based material characterisation techniques in very high fields

Capacitor bank (© HLD, HZDR)

Developments 2019

Poland member of the European Magnetic Field Laboratory

The Ministry of Science and Higher Education in Poland has awarded funding a consortium of Polish universities, led by the University of Warsaw to secure access to the European Magnetic Field Laboratory (EMFL) for the Polish user community.

The other members of the EMFL are the French Centre National de la Recherche Scientifique, with sites in Grenoble and Toulouse, the Dutch Radboud University/NWO in Nijmegen, the German Helmholtz-Zentrum Dresden-Rossendorf and the University of Nottingham representing the UK research community.

The EMFL was formally founded in January 2015 with support from the European Community through the ESRFI Roadmap. It aims to develop and operate world-class high magnetic fields – both continuous and pulsed - and to use them for excellent research by both inhouse and external users. High magnetic fields are one of the most powerful tools available to scientists for the study, the modification, and the control of the state of matter.


© Minimus

The University of Warsaw will represent Poland in the EMFL for a duration of five years, starting from 1st of January 2019. The membership enables Polish users access to all the EMFL installations and measurement techniques, expert support from local staff members, as well as funding for travel and subsistence.

Prof. Adam Babiński (University of Warsaw): ”The continuous involvement of Polish researchers in high-magnetic-field studies has been substantially supported by the Ministry of Science and Higher Education of Poland. The grant from the Ministry, which is managed by the University of Warsaw, allows Poland to join EMFL as a member. We believe that this will significantly support the Polish high-field research community as it opens new perspectives for cooperation within this unique European infrastructure. We expect that our contribution is also a benefit for EMFL, as we add new people and ideas. It confirms the significance of research in high magnetic fields in creation of the European Research Area.”

Wosnitza: “Our scientific collaboration with the Polish user community has always been very strong. This grant from the Polish ministry and the EMFL membership is a reward for our longstanding relationship and scientific achievements.”

Prof. Adam Babiński will be representing the Polish community including the University of Warsaw and indirectly the Polish Ministry for Science and Higher Education, and will be participating in the EMFL Council meetings.

2.5 Million ERC Advanced Grant to study superconductivity under extreme conditions

Experimental physicist Nigel Hussey has received a prestigious € 2.5 million grant from the European Research Council (ERC) to study the flow of charge in exotic metals and superconductors under extreme conditions. The ultimate goal is to understand superconductivity and create a pathway towards room-temperature superconductors.

Hussey: ”This is very challenging. We want to understand how superconductivity works, but nature keeps playing games with us. In order to understand a superconductor, you also need to destroy it and here at our EMFL facility in Nijmegen we use extreme conditions to study the behavior of electrons in the metallic state.”


© Gideon Laureijs, HFML, Nijmegen

Hussey is interested in how a good metal becomes bad and ‘breaks down’ all of a sudden. He will use his ERC funding to test his idea that while high-temperature superconductivity is initially borne out of the interaction that causes the electrons to pair up in the superconducting state, it is ultimately destroyed by it, since the scattering becomes so strong that the electronic states required to form the superconductor are themselves destroyed. “With this grant, I have the unique opportunity to set up my own research group dedicated to this task. By exposing exotic metals to extreme conditions like the high magnetic fields at HFML, the intense radiation of the free-electron lasers at the FELIX Laboratory, high pressures, and very low temperatures I hope to find out what exactly happens.”

“The scientists that judged my proposal called it controversial, highly ambitious, and on the edge. It’s high risk, high gain. But even if my idea is proven wrong, we will nonetheless be one step closer to identifying the physics behind strange-metal behavior. It will be an important key step in the development of a coherent theory for high-temperature superconductivity, which in turn may provide key guiding principles in our quest for materials with ever higher transition temperatures.”

EMFL technical exchange visits between Grenoble and Nijmegen

Whereas most of the scientists already know the different EMFL facilities and their activities from visits, conferences and workshops, there is less contact between technical teams. In order to further expand the collaboration between the EMFL laboratories at this level, an initiative for exchange was launched that finally picked up speed: In September 2018, three members of the instrumentation team from HFML Nijmegen visited LNCMI Grenoble and in January 2019 a return visit of seven members of the Grenoble instrumentation team took place.

Both hosts organized a tailored program combining visits of the facilities and their instrumentation infrastructure with ample time for exchange in small groups and on a specialist level. By easily overcoming the language barrier all the participants quickly engaged themselves in interesting and fruitful discussions on the very large field of instrumentation in high magnetic fields. The topics of discussion covered the choice of materials and fabrication techniques, the development and operation of cryogenic devices, the various methods for calibration of magnetic field and temperature, the software user interfaces running the magnet and the scientific experiments, issues of user support as well as original developments of recent experimental set-ups operating in this challenging environment.

During the visits all participants realized that fruitful exchange on instrumentation strongly profits from personally knowing the colleague in the other laboratory, staying there on the site, and putting hands on the objects. After respectively three days of visit the instrumentation teams of both laboratories got many inspirations for future collaborations as well as for their daily work at home. They would like to thank the administration teams at HFML Nijmegen and LNCMI Grenoble for their help and both directors for financial support. All the participants are already looking forward to further visits and an enlargement of the exchange to the EMFL sites in Dresden and Toulouse in the near future.


© Milan Horvatić, LNCMI, Grenoble

© Gideon Laureijs, HFML, Nijmegen

HFML and LNCMI instrumentation teams during the exchange visits at LNCMI Grenoble (left) and HFML Nijmegen (right).

Report from the EMFL user meeting - Warsaw June 25th, 2019

The eleventh EMFL User Meeting was held at the University of Warsaw on 25th of June 2019. This was the second time that the User Meeting took place outside one of the EMFL high-field facilities. With over 50 participants, it was very well attended. Warsaw was chosen as venue to particularly promote the exchange of ideas and wishes with our (future) Polish users. Since this year, Poland is the newest member of the EMFL. This was possible through a grant from the Polish ministry of Education to a consortium of Polish high-magnetic-field users, that is being coordinated by Prof. Adam Babiński (University of Warsaw), who also hosted the meeting. The User Meeting included two scientific and one technical session, to showcase some of the most recent scientific highlights as well as new technical and instrumentational developments at the high-field facilities.

The technical session focussed on recent progress and developments in magnet technology particularly on the superconducting technology for which Xavier Chaud showed outstanding new results using high-Tc coils in Grenoble. Jerome Beard presented the planned upgrade of the Toulouse capacitor bank, allowing to store more energy and an even more reliable use of the installation. Jake Ayres' work focused on high-pressure experimental results that were obtained in Nijmegen and, finally, Toni Helm showed the possibilities of focussed ion beams to microstructure samples for experimental investigations under extreme conditions.

The scientific highlights were of a very high quality and covered many areas of topical interest including 2D materials, transition-metal dichalcogenides (TMDCs), perovskites, strange metals, correlated systems, and superconductors. The talks illustrated the wide variety of research topics that can be investigated using intense magnetic fields. The User Committee meeting was chaired by Raivo Stern (NICPB, Tallinn, Estonia) who reported the outcome of the meeting and the suggestions of the Committee back to the Board of Directors at the end of the meeting.

We would like to thank all the staff at the University of Warsaw, and especially Prof. Adam Babiński, for their excellent organization and for the diverse and inspiring meeting. The next EMFL meeting will be held at the HLD in Dresden, Germany, in June 2020.

© Martin van Breukelen, HFML, Nijmegen

User Committee meeting in Warsaw

During the EMFL User Meeting, the EMFL User Committee meeting was held on the 25th of June 2019 at the Physics Faculty of Warsaw University as well. Five of the nine members of the User Committee (R. Stern, M. Doerr, A. Arora, S. Tozer, V. Skumryev) and a number of users attended the meeting, with Prof. Stern chairing the committee. The meeting was followed by a discussion meeting with the Board of Directors of the EMFL and the user community. Several matters were discussed and recommendations made to the Board of Directors.

The User Committee acknowledged Prof. Adam Babiński from Warsaw University and the Board of Directors for arranging an excellent user workshop, where both users and representatives of the EMFL reported on recent developments of high-magnetic-field infrastructures and equipment, 2D materials in high magnetic fields, magnetocaloric materials in pulsed magnets, and novel material systems of fundamental and technological interest. The user community received this rich program very well.

EMFL Prize Winner 2019: Ashish Arora

During the EMFL User Meeting in Warsaw, the yearly EMFL prize was awarded. This time, Dr. Ashish Arora, postdoctoral researcher at the University of Munster, had the honor to receive the prize. Jochen Wosnitza, Director of the Dresden High Magnetic Field Laboratory handed over the award. Dr. Ashish Arora received the award for his groundbreaking discoveries using the excellent infrastructure at the EMFL facilities. He is working on optical properties of transition-metal dichalcogenides, particularly on the control of the spin and valley degrees of freedom using high magnetic fields. Since 2009, the EMFL members award annually the EMFL prize for exceptional achievements in science done in high magnetic fields.


© EMFL

Prof. Jochen Wosnitza congratulates the EMFL prize winner, Dr. Ashish Arora.

HFML-FELIX: Official opening combined building

The combined building of the HFML and the FELIX Laboratory has been officially opened on July 8, 2019. Ingrid van Engelshoven, Minister of Education, Culture and Science, officiated the opening.

The very powerful magnets and free-electron lasers of the large-scale infrastructures draw scientists from around the world who want to study the properties and functions of matter. No other facility offers both static high magnetic fields and intensive (far) infrared light at a single location.

© Dick van Aalst, RU, Nijmegen

From left to right: Prof. Han van Krieken (Rector, RU), Dr. Britta Redlich (Director FELIX Laboratory), Minister Ingrid van Engelshoven (OCW), Prof. Peter Christianen (Director HFML), Prof. Lutgarde Buydens (Dean FNWI, RU), Prof. Niek Lopes Cardozo (NWO), Dr. Wilma de Koning (University Board, RU), Dr. Iwan Holleman (Director FNWI, RU), Prof. Daniël Wigboldus (President of the University Board, RU).

Groundbreaking discoveries are already made in the separate laboratories. Using the powerful magnetic field at HFML, Konstantin Novoselov and Andrei Geim were the first to discover the 2D material graphene. A Nobel Prize-winning, fundamental discovery that paved the way to new types of electronics. The strong laser light at FELIX plays a crucial role in the mapping of chemical processes and molecular structures, among others. An example is the study into new biomarkers that help physicians in the tracking of various diseases.

The laser light reaches the magnets from the laser basement through an 86-meter vacuum pipe, in which it is directed by 41 gilded mirrors. “Getting this to work was a huge challenge,” says HFML Director Peter

Christianen. "It is a new combination of technology, and we, therefore, had to come up with everything ourselves, make it or have it made, test it, double check: am I measuring what I want to measure, or do I have noise on the line? For example, once it was in the magnetic field, the helium that we use to cool our experiments had an unintentional interaction with the photons of the laser."

"With this combination of our infrastructure, we enter an entirely new scientific domain. It is impossible to predict which breakthroughs we will make. One could compare this with a new building in which all doors are closed. One magnetic field strength combined with one light frequency can open one door, thus allowing us to see what is behind it. We now have the unique opportunity to change both the magnetic field strength and the frequency of the light at will. This will allow us to open all doors at the same time," says FELIX Director Britta Redlich.

© Dick van Aalst, RU, Nijmegen

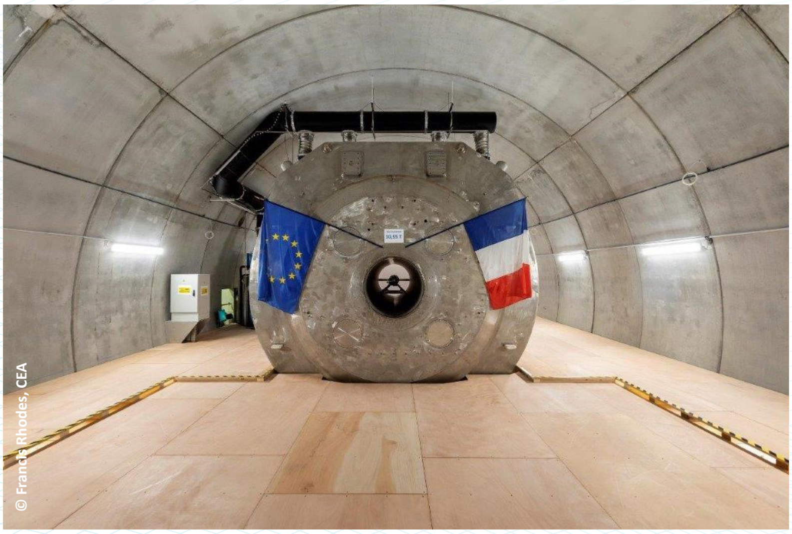
The combined HFML-FELIX building.

CEA-IRFU new member of EMFL

The CEA-IRFU has a longstanding involvement and experience in the development of high-field/high-volume superconducting magnets. CEA-IRFU is, therefore, interested in strengthening its links with the EMFL facilities to develop the next generation of superconducting high-field magnets.

Dr. Pierre Vedrine, the head of the Accelerator, Cryogenics, and Magnetism Department (DACM): "EMFL and CEA-IRFU have complementary skills in the area of magnet technology, enabling to collect the scientific needs and to be able to provide the necessary tools for advances in fundamental and applied research."

Dr. Rikken (chair of the EMFL board of directors): "Our scientific and technical collaboration with CEA-IRFU has always been very strong. This membership of CEA-IRFU is a consolidation of our longstanding relationship"


© Francis Rhodes, CEA

11.7 T whole-body MRI magnet.

Dr. Pierre Vedrine will be representing CEA-IRFU in the EMFL Council.

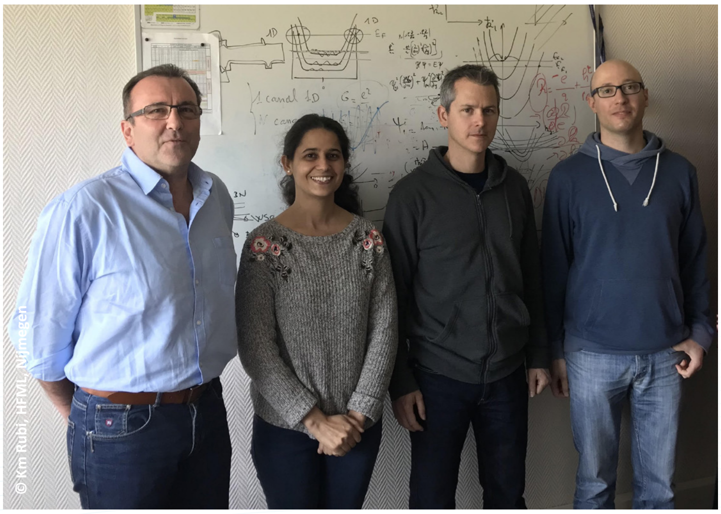
CEA-IRFU is the most recent member of the EMFL. Other members are the French Centre National de la Recherche Scientifique, with sites in Grenoble and Toulouse, the Dutch Radboud University/NWO in Nijmegen, the German Helmholtz-Zentrum Dresden-Rossendorf, the University of Nottingham representing the UK research community and the University of Warsaw representing the Polish research community.

EMFL secondments

In 2019, the two first scientific secondments funded by the newly implemented exchange program of the EMFL have taken place.

PhD student Adrià Gràcia-Condal from the University of Barcelona came to visit the HLD at the Helmholtz-Zentrum Dresden-Rossendorf and Km Rubi from HFML, Nijmegen went to visit LNCMI in Grenoble.

For Adrià Gràcia-Condal the scientific purpose of the visit was to design, to manufacture, and to assemble a new uniaxial-load cell for the use in pulsed magnetic fields. With the new insert, direct measurements of the adiabatic temperature change of materials in magnetic field pulses up to 70 T are now feasible, enabling to study the influence of uniaxial loads up to 100 MPa in a constant force regime.


© Km Rubi, HFML, Nijmegen

Km Rubi with the "Nano-objects and Semiconducting Nano-structures" group at LNCMI-Toulouse. From left to right: Prof. Michel Goiran, Dr. Km Rubi, Dr. Walter Escoffier and Dr. Mathieu Pierre.


© Bernd Schröder, HZDR, Dresden

From left to right: Dr. Tino Gottschall, Adrià Gràcia-Condal, and Eduard Bykov while inspecting the new measuring device, before submitting it to first pulsed-field experiments.

Km Rubi used the secondment to perform electrical-transport experiments in both pulsed and DC field facilities since these installations involve different equipment, such as dedicated probes, sample holders, and electrical devices for the measurements. Her exchange visit contributed meaningfully to an optimization of future combined magnetotransport measurements in pulsed and continuous magnetic fields.

Scientific Highlights

Pressure tuning of exchange coupling in a frustrated magnet

Spin-1/2 triangular-lattice Heisenberg antiferromagnets represent one of the most important classes of frustrated quantum magnets, demonstrating a complex interplay between geometrical frustration, quantum fluctuations, and magnetic order. In spite of their simple magnetic structures (Figure, inset), they possess highly unusual magnetic properties and a very rich – and not fully understood – phase diagram. One major obstacle in this area of research is the lack of materials with appropriate, ideally tuned, magnetic parameters.

Using Cs_2CuCl_4 as a model system, we demonstrate an alternative approach, where, instead of the chemical composition, the spin Hamiltonian is altered by hydrostatic pressure. The approach combines high-pressure high-field electron spin resonance (ESR), performed at the Tohoku University in Sendai, Japan, and magnetization measurements, done at the National High Magnetic Laboratory in Tallahassee, USA. The results allowed us not only to quasi-continuously tune the exchange parameters, but also to accurately monitor them by measuring the pressure-dependent shift of the ESR lines (Figure).

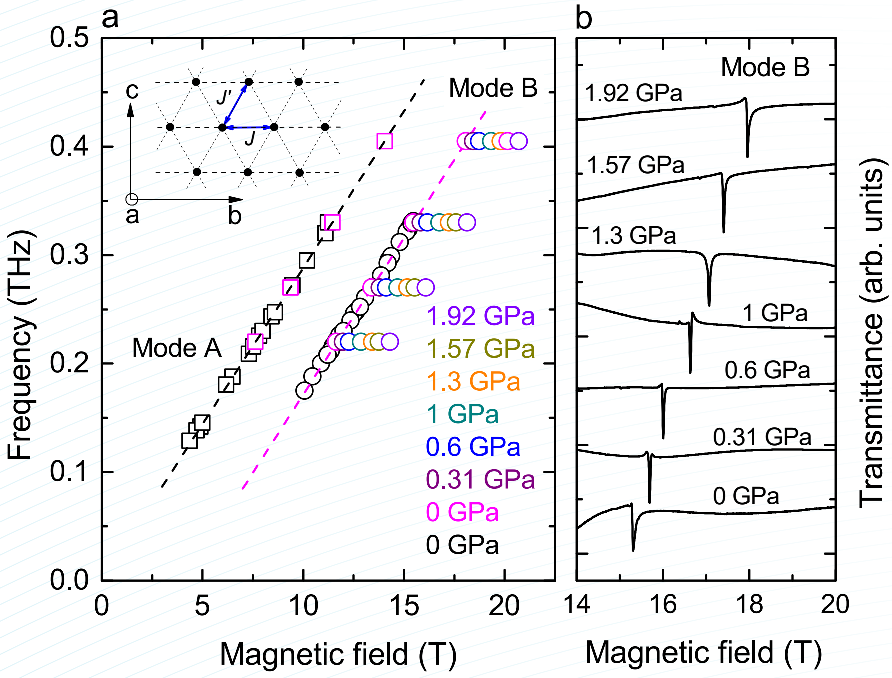


Figure: Pressure dependence of ESR in Cs_2CuCl_4 at 1.9 K. a) Frequency-field diagram of magnetic excitations at different pessures, i.e., acoustic (mode A) and optical (mode B) magnon. The inset shows a schematic picture of magnetic sites and exchange couplings in a triangular layer of Cs_2CuCl_4. b) ESR spectra of the optical magnons taken at a frequency of 330 GHz at different pressures (the spectra are offset for clarity).

The application of a pressure of up to about 2 GPa increases the exchange-coupling parameters in this compound by up to 70%, triggering, at the same time, a cascade of new low-temperature field-induced phase transitions, absent at zero pressure.

Reference

Zvyagin, S.A., D. Graf, T. Sakurai, S. Kimura, H. Nojiri, J. Wosnitza, H. Ohta, T. Ono and H. Tanaka (2019). “Pressure-tuning the quantum spin Hamiltonian of the triangular lattice antiferromagnet Cs_2CuCl_4”. *Nature Communications*, 10 (1): 1064.

The high-field HTS insert Nougat reached a record field of 32.5 T

The High Temperature Superconductor (HTS) team at LNCMI has set a new world record by producing a magnetic field of 32.5 T for a period of several minutes. With this, EMFL is paving the way for the production of a very intense magnetic field -from 30 to 50 T- continuously, by devices that are completely superconducting and, therefore, particularly energy efficient. In the frame of EMFL, the development of HTS inserts aims at enabling long-duration experiments above 23 T at a much lower cost. Many areas of research will benefit: NMR spectroscopy, thermonuclear fusion, magnetic levitation, etc.

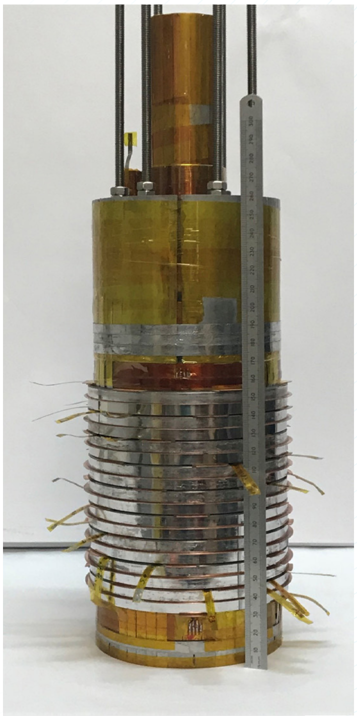


Figure 1: The HTS insert NOUGAT after assembling of its 9 double pancakes and overbanding, ready to be instrumented and mounted.

Developed in the CNRS / LNCMI laboratory in Grenoble, the HTS insert Nougat is the result of a CEA-CNRS collaboration, funded by the French Research Agency ANR. The use of the innovative technique „Metal-as-Insulation“ made it possible to ensure stable operation and eliminates any risk of irreversible damage in the event of an incident [1]. By co-winding the HTS tape with a metal ribbon, without isolation and without impregnation, allows the redistribution of the current between the winding turns in case of local HTS failures with excellent protection against excessive overheating, and provides the additional mechanical reinforcement necessary to counteract the very high magnetic forces at these field values.

The test campaign of the high-field HTS Nougat insert was successfully conducted at the CNRS / LNCMI in Grenoble. The insert reached twice its nominal operating point of 30 T, of which 12 T were generated by the superconducting magnet alone. The insert operated more than 6 minutes above this value with dwells at 31 T, then 32 T and a new world record was set for a superconducting insert of this size (useful diameter of 38 mm) with a central magnetic field of 32.5 T of which 14.5 T are produced by the superconducting magnet only.

This result demonstrates that the „Metal-as-Insulation“ technology is now mature. A magnet generating magnetic fields greater than 30 T with an HTS insert is now feasible. This work also paves the way for significant energy savings, as it partially can replace experiments on multi-megawatt resistive installations of a few tens of kilowatts with superconducting magnets.

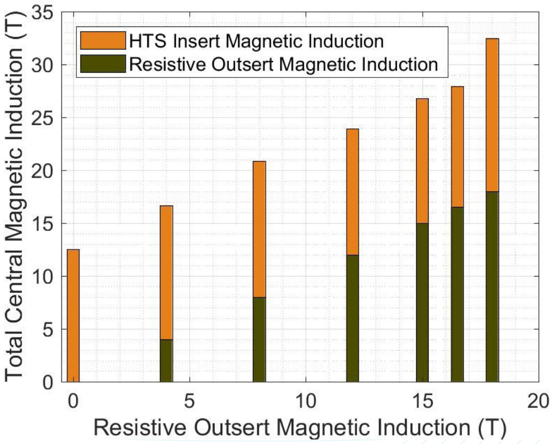


Figure 2: Representation of several operating points reached as a function of external background field.

Reference

Song, J.-B., X. Chaud, B. Borgnic, F. Debray, P. Fazilleau and T. Lecrevisse (2019). “Construction and Test of a 7 T Metal-as-Insulation HTS Insert Under a 20 T High Background Magnetic Field at 4.2 K”. *IEEE Transactions on Applied Superconductivity*, 29 (5): 4601705.

Insulating states of replica Dirac Fermions in graphene superlattices

Two-dimensional layers of graphene and hexagonal boron nitride (hBN) both have a honeycomb atomic structure, with a slight lattice mismatch of 1.8 %. When placing graphene on top of hBN one forms a so-called moiré pattern, with a large periodicity of $\lambda \approx 15$ nm in case of perfect crystallographic alignment (Figure (a)). Subjecting these moiré superlattices to high magnetic fields creates a fractal energy spectrum in the two-dimensional electron system, the so-called Hofstadter butterfly. More specifically, every time that rational values of flux quanta $\phi_0 = h/e$ thread the superlattice unit cell, replica of the original Dirac fermions are created. At $\phi/\phi_0 = 1$, these new particles behave as if subjected to an effective magnetic field $B_{eff} = B - 22$ T.

Researchers from HFML-RU/NWO in Nijmegen, in collaboration with colleagues from the University of Manchester, have investigated the Landau quantization of these replica Dirac fermions using temperature-dependent magnetotransport experiments in magnetic fields up to 35 T. The study revealed that the replica Dirac particles form field-induced insulating states, with an energy gap for both the bulk and edge excitations, reminiscent of that of the "original" ones. In Figure (b) one can observe such states as bright areas in the color-map of the two-terminal resistance, corresponding to regions of low (effective) filling factor. The insulating states were characterized quantitatively by determining the field dependence of their energy gaps, estimated from temperature activation of the four-terminal resistance. Combining these data with a simple theoretical model, the researchers realized that the replica particles created at 22 T have reduced Fermi velocity and a gap at the Dirac point. These results open the possibility of using magnetic fields with tuned two-dimensional superlattices to create Dirac fermions with on-demand Fermi velocity and gap size.

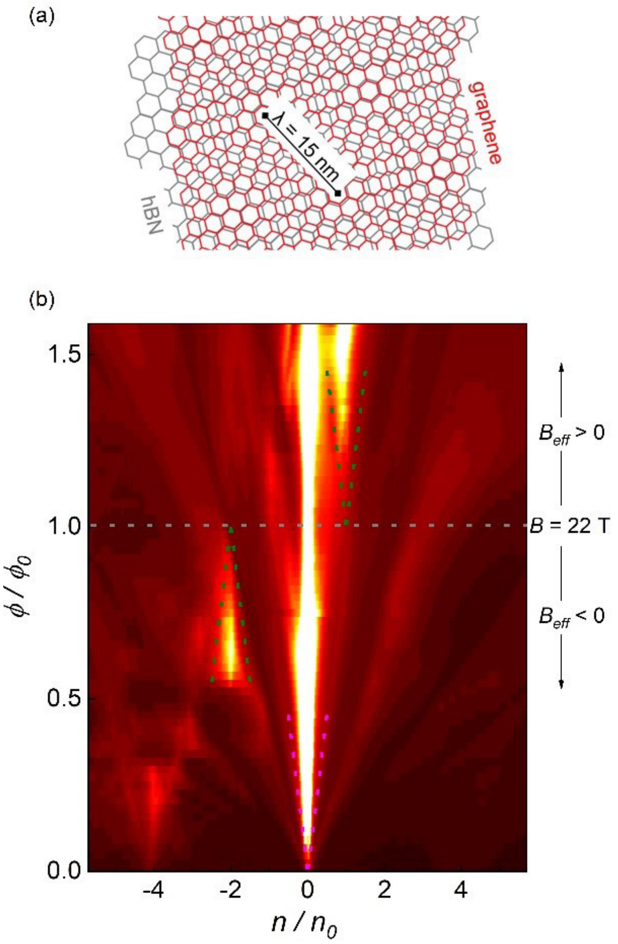


Figure: (a) Sketch of single-layer graphene aligned on top of hBN. The lattice periodicities and mismatch are exaggerated to allow easier visualization of the moiré superstructure. (b) Color plot of the two-terminal resistance measured at 1.5 K on an aligned graphene/ hBN Hall-bar device (fabricated at University of Manchester). The x-axis (y-axis) indicates the number of electrons (flux quanta) per superlattice unit cell. The dashed magenta (green) lines delineate the regions of (effective) filling factor less than 1 investigated for the original (replica) Dirac particles.

Reference

Pezzini, S., S. Wiedmann, A. Mishchenko, M. Holwill, R. Gorbachev, D. Ghazaryan, K.S. Novoselov and U. Zeitler (2019). "Field-induced insulating states in a graphene superlattice". *Physical Review B, Editor's Suggestion*, 99: 045440.

Phase-transition-induced carrier-mass enhancement in 2D Ruddlesden-Popper perovskites

Organic-inorganic halide perovskites have become the “next big thing” in emerging semiconductor materials, with their unprecedented rapid development and successful application in high-performance photovoltaics. Yet, their inherent instabilities with respect to moisture remain a crucial challenge for these materials. This directed the interest of the scientific community to perovskite derivatives such as two-dimensional (2D) perovskites. These materials are significantly more stable and possess higher tunability of their properties which expands the field of their application from energy harvesting through LED to single-material-white-light emitters.

The 2D perovskites are often regarded as perfect quantum wells, because they are not plagued by interfacial roughness or intermixing characteristics of epitaxially grown quantum wells. The well layers consist of planes of lead-halide octahedra, separated by organic spacers. The research of these natural perovskite quantum wells is in its infancy and their structural, dielectric, optical, and excitonic properties remain to be explored, in particular the influence of organic spacers. Although the band-edge states are composed of lead and halide orbitals, the organic ligands affect the band structure and the electron-phonon coupling, via distortion of the octahedral cages. The optical properties of these materials are dominated by strong electron-hole attraction, resulting from dielectric confinement. Very often these materials exhibit complex absorption and emission spectra with many sidebands. Their origin generates much controversy since they can be attributed to phonon replicas or to bound excitonic states. We address this issue for $(C_nH_{2n+1}NH_3)_2PbI_4$ (with n = 4, 6, 8, 10, 12) by means of optical spectroscopy in magnetic fields up to 67 T. We show that the complex absorption features shift parallel in magnetic field, indicating the phonon-related nature of the observed side bands. Moreover, we have found that the diamagnetic shifts of the high- and low-temperature crystal phases of the investigated materials are significantly different (Figure), pointing to a notable modification of the carrier effective mass and/or dielectric screening upon the phase transition into the low-temperature phase, entailing an octahedral distortion. Since the phase transition occurs close to room temperature, our results provide an additional way for 2D perovskite engineering via moderate cooling achievable by Peltier coolers.

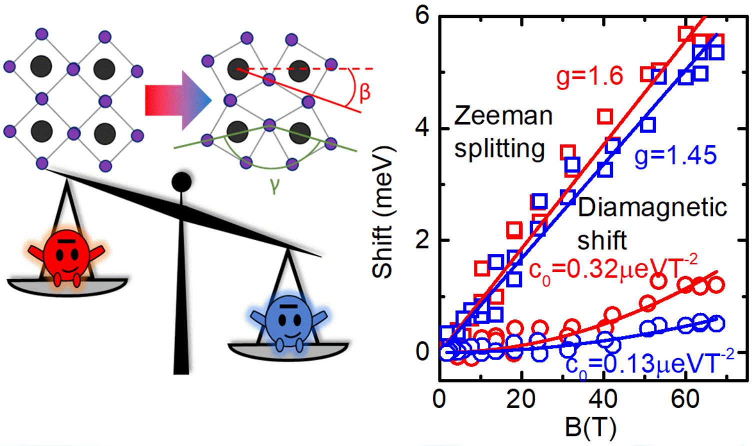


Figure: Zeeman splitting and diamagnetic shift of the high- and low-temperature phase of the crystals with n = 8.

Reference

Baranowski, M., S.J. Zelewski, M. Kepenekian, B. Traoré, J.M. Urban, A. Surrente, K. Galkowski, D.K. Maude, A. Kuc, E.P. Booker, R. Kudrawiec, S.D. Stranks and P. Plochocka (2019). “Phase-Transition-Induced Carrier Mass Enhancement in 2D Ruddlesden-Popper Perovskites”. *ACS Energy Letters*, 4 (10): 2386-2392.

Magnetic shape memory effects and magneto-structural coupling in $Fe_{1+y}Te$

Recently, researchers from different institutions in Dresden found two different types of magnetic shape memory effects in the enigmatic compound $Fe_{1+y}Te$. Such effects are extraordinary phenomena referring to a change in shape and/or size of a magnetic material upon applying a magnetic field. These effects emerge from either a persistent de-twinning of a twinned magnetically ordered material, in which the crystallographic axes are irreversibly reoriented by the applied magnetic field, or a magneto-elastic phase transition driven by an external magnetic field. Typically, these effects are observed in ferromagnetic materials with strong spin-lattice couplings, and the two types are rarely found in the same material. Conventional shape memory alloys have found a tremendous number of applications in biomedical, technological, domestic, and textile industries.

However, magnetic shape memory effects are not commonly observed in antiferromagnets, and the exact mechanisms driving the effects are not well understood. Therefore, the identification of a new class of materials where these types of transformation in crystalline solids can be observed is expected to provide new and much-desired insight. The experimental results clearly indicate that the two above-mentioned magnetic shape memory effects take place in the low-temperature antiferromagnetic phase of the material $Fe_{1+y}Te$ ($y = 0.11, 0.12$). The antiferromagnetism of the monoclinic ground state allows for a magnetic-field-induced reorientation of the twin variants by the motion of one type of twin boundary, as evidenced by jumps in the magnetization (Figure) and magnetostriction measured along certain crystallographic directions in high applied magnetic fields.

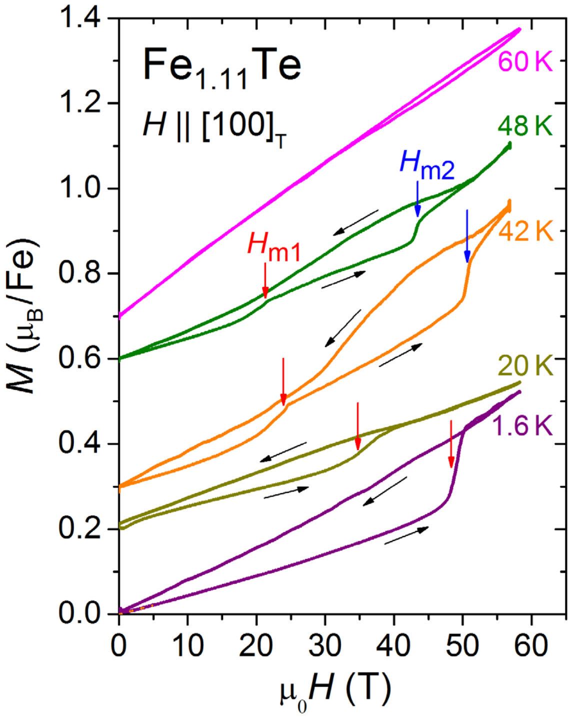


Figure: Magnetization measurements up to 60 T on a $Fe_{1.11}Te$ single crystal at different temperatures. At $T = 1.6$ K, a jump is observed at H_{m1} (red arrows) which is not seen for decreasing field, consistent with a magnetic shape memory effect. H_{m1} shifts to lower magnetic fields as T is increased. At 42 K and higher, a second transition H_{m2} is found (blue arrows). In the paramagnetic phase above 57 K, the transitions are no longer observed. Black arrows indicate the direction of the field sweep.

At even higher magnetic fields, a second transition is observed, e.g., at about 52 T at 1.6 K for $Fe_{1.12}Te$. This second transition is isotropic in nature, which calls for a different underlying mechanism. Yet, its irreversible behavior also indicates a memory effect. Accompanying density functional theory (DFT) calculation allowed us to estimate the strength of the magnetocrystalline anisotropy and the direction of the magnetic easy axis.

Reference

Rößler, S., C. Koz, Z. Wang, Y. Skourski, M. Doerr, D. Kasinathan, H. Rosner, M. Schmidt, U. Schwarz, U.K. Rößler and S. Wirth (2019). “Two types of magnetic shape-memory effects from twinned microstructure and magneto-structural coupling in $Fe_{1+y}Te$”. *Proceedings of the National Academy of Sciences*, 116 (34): 16697-16702.

Cyclotron emission from massless Kane electrons

When a magnetic field is applied to a solid, the continuous density of electronic states transforms into a set of discrete energy levels, known as Landau levels. Electrons excited in such a ladder may recombine, with emission of photons. This process can be viewed as the inverse of a cyclotron resonance and it is referred to as ‘cyclotron emission’. The idea to construct a Landau-level laser via stimulated cyclotron emission is as old as the experimental realization of the very first laser itself, and wavelength tunability is the great advantage of this concept. The strength of the magnetic field defines the spacing between Landau levels, and, therefore, also the emission frequency of the laser. This frequency typically corresponds to the far-infrared (THz) spectral range. The successful realization of a Landau-level laser would thus bridge the so-called terahertz gap, which still exists despite the considerable efforts of several generations of physicists. So far, however, despite many efforts, this appealing concept never progressed to the design of a reliable device. This is because of the efficient Auger scattering of Landau-quantized electrons, an intrinsic non-radiative recombination channel that eventually gains over cyclotron emission in all materials studied so far (conventional semiconductors with parabolic bands, but also in graphene with massless electrons). Auger processes are favored in these systems because the Landau levels (or their subsets) are equally spaced in energy. Recently, researchers from Grenoble, Dresden, Montpellier, and Novosibirsk have explored the Auger processes and cyclotron emission in gapless HgCdTe, a ternary compound with three-dimensional massless Kane electrons. They find that the unwanted Auger processes are significantly suppressed and the lifetime of excited Landau-quantized massless Kane electrons reaches the nanosecond range. It is thus, under comparable conditions, by two or three orders of magnitude longer than for electrons in graphene or conventional semiconductors. The difference is related to the particular spacing of the Landau levels in gapless HgCdTe, which does not include subsets of equidistant levels (for low-energy Landau levels). Consistently with this finding, profound (spontaneous) cyclotron emission from massless Kane electrons has been observed. Systems hosting massless Kane electrons are thus promising candidates for the active medium of a Landau-level laser, which would, in this particular case, operate in the THz and infrared spectral ranges and would be widely tunable by very low magnetic fields.

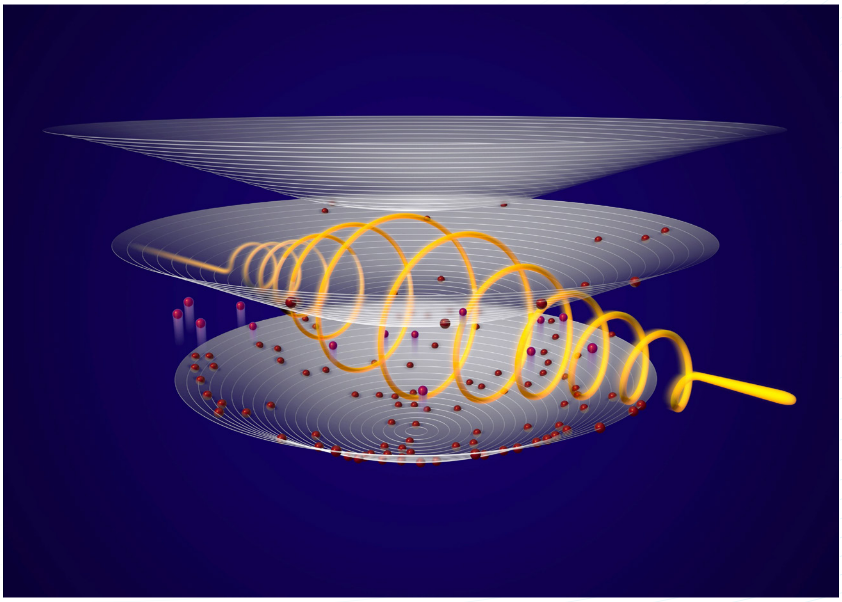


Figure: Artist view of cyclotron emission from Landau-quantized massless Kane electrons.

Reference

But, D.B., M. Mittendorff, C. Consejo, F. Teppe, N.N. Mikhailov, S.A. Dvoretskii, C. Faugeras, S. Winnerl, M. Helm, W. Knap, M. Potemski and M. Orlita (2019). “Suppressed Auger scattering and tunable light emission of Landau-quantized massless Kane electrons”. *Nature Photonics*, 13 (11): 783-787.

Electrical resistiviy across a nematic quantum critical point

It is not only elemental or ordinary metals that superconduct. Today, scientists are also fascinated by strange metals that undergo phase transitions (e.g., to a magnetic state) before superconductivity sets in. If they find the right tuning knob, scientists can suppress the temperature at which this transition occurs, driving it to 0 K. When doing so, the electrons start fluctuating quantum mechanically between the magnetic and non-magnetic phases without any thermal agitation. This is the quantum critical point. Accessing this quantum critical point is important for two reasons. Firstly, when the temperature is just above the critical point, the resistivity of the strange metal acts in a way that goes against every conventional theory. Secondly, it is highly likely that these critical fluctuations that cause the strange resistance are also responsible for inducing superconductivity, so if scientists can access this strange metallic state and study its behavior, they might be able to identify the interaction what causes superconductivity in these exotic systems.

Researchers from HFML in Nijmegen, together with Japanese collaborators, thought of a way to make superconductivity disappear and explored the metallic state down to the lowest temperatures possible. In FeSe, the electrons appear to undergo a transition to a purely nematic phase at a temperature close to 100 K. When exactly 1/6 of the Se atoms are substituted with S atoms, the transition temperature to the nematic phase is suppressed to 0 K. The quantum critical point itself is still ‘protected’ by a veil of superconductivity that must first be removed. In high magnetic fields, however, superconductivity will eventually succumb. Then, the strange metallic state revealed itself, extending all the way down to temperatures just one degree above absolute zero. As the quantum critical point is approached, the electrons become progressively heavier, ‘weighed down’ by the intensifying fluctuations of the nematic order.

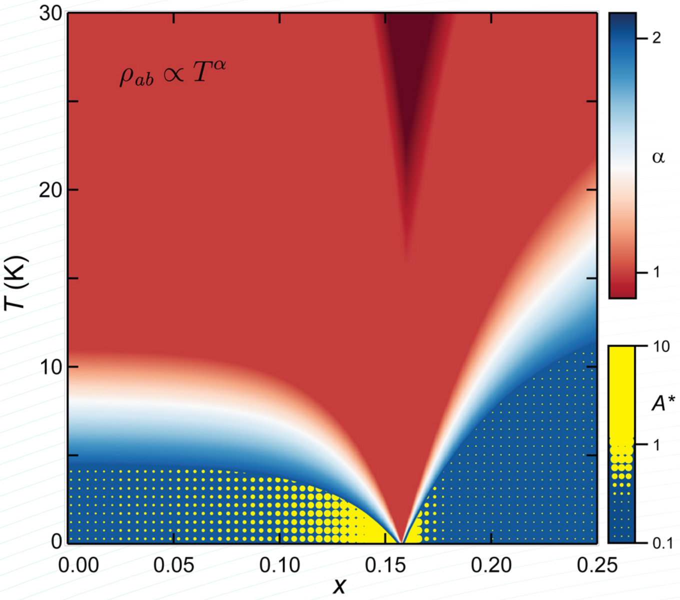


Figure: Low-temperature phase diagram of FeSe$_{1-x}$S$_x$ described in terms of the exponent of the T-dependent resistivity that is itself defined in the upper color scale. The density of dots inside the T^2 regime indicate the strength of A, the coefficient of the T^2 resistivity, normalized to a fixed charge-carrier density (and defined in the lower color scale).*

The outcome was different from what the team expected. First of all, strange-metal behavior had only been seen previously in systems close to a magnetic quantum critical point, never close to a purely nematic one. Indeed, there is currently no theoretical model that predicts this behavior. Secondly, while the critical fluctuations become stronger the nearer the system is to the nematic quantum critical point, the superconductivity itself does not become stronger. It raises new questions and begs for more research. How do electrons interact with nematic fluctuations to cause strange metallic behavior in the first place? Why is superconductivity in this particular system not enhanced near the quantum critical point? Nematic fluctuations are one possible route to high-temperature superconductivity, but not, it seems, in the iron chalcogenides. Nevertheless, understanding what first inhibits the growth of superconductivity can help us understand what makes it grow.

Reference

Licciardello, S., J. Buhot, J. Lu, J. Ayres, S. Kasahara, Y. Matsuda, T. Shibauchi and N.E. Hussey (2019). “Electrical resistivity across a nematic quantum critical point “. *Nature*, 567: 213-217.

Viscosity measurements in pulsed magnetic fields

A quartz-crystal microbalance (QCM) is an ultrasensitive device to detect changes of the mass. When an external mass is coupled to the surface of the quartz micromembrane, the resonance frequency f_0 of the QCM decreases. Owing to the high quality factor, Q, of the QCM, a relative frequency change of 10^{-9} can be resolved. Immersed in liquid, the QCM oscillates still in resonance, but with significantly decreased f0 and Q. This reduction is proportional to $(\rho\eta)^{0.5}$, where ρ is the mass density and η is the shear viscosity of the liquid. Thus, the QCM is a useful device to investigate the viscous properties of liquids with high resolution.

Viscosity measurements using a QCM in combination with pulsed magnetic fields were developed at the HLD (Figure). In these experiments, we use a commercial AT-cut quartz resonator chip (thickness-shear mode). The advantages to use a commercial chip are the following. First, the QCM is relatively stable and robust against mechanical vibrations and turbulences in liquid. Second, it has high f_0 and Q, leading to higher sensitivity. Here, a high f_0 is favorable for a high repetition rate as well. Third, the QCM is relatively small and cheap.

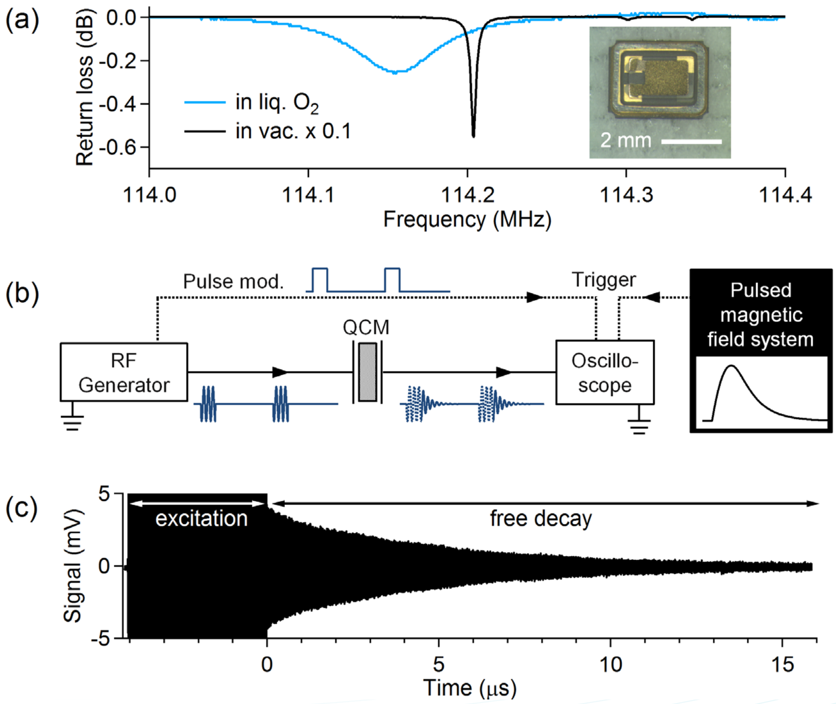


Figure: (a) Return loss spectra of the QCM in liquid oxygen (cyan) and in vacuum (black).The photograph shows the used QCM. (b) Schematic diagram of the ring-down measurement. (c) Typical free-decay curve of the QCM, which is fitted by an exponentially damped sinusoid.

During the magnetic-field pulse, f_0 and Q of the QCM are measured using a ring-down dissipation monitoring technique, by which we can simultaneously monitor both quantities with a repetition rate of 10 kHz. In this technique, the QCM is intermittently excited by an RF generator. Even after the RF generator is switched off, the mechanical oscillation of the QCM persists with exponential decay. This residual oscillation directly reflects the resonant properties of the QCM, characterized by f_0 and Q. The typical resolution of $(\rho\eta)^{0.5}$ is 0.5 %. As a benchmark, the viscosity of liquid oxygen was measured up to 55 T.

Reference

Nomura, T., S. Zherlitsyn, Y. Kohama and J. Wosnitza (2019). “Viscosity measurements in pulsed magnetic fields by using a quartz-crystal microbalance”. *Review of Scientific Instruments*, 90 (6): 065101.

Organisational structure

EMFL's objective, without profit aim, is to unite world-class high magnetic field facilities and to make them available for excellent research by users. More specifically, EMFL is responsible for the management of access, networking and coordination activities of the high-field facilities in Europe.

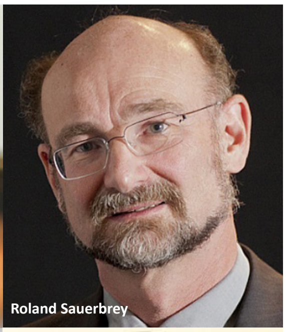
Council

The Council is the highest governing body of EMFL and consists of the EMFL Member representatives. The council does:

- appoint and dismiss the Directors and approve the candidacy of the executive manager,
- admit and dismiss EMFL Members,
- approve the progress report, annual accounts and the budget presented by the Board of Directors,
- amend the Statutes and approve the vision, mission and definition of values of the Association,
- discuss and develop strategic, scientific and technical plans of the EMFL.

The Council exists of:

Han van Krieken (RU/NWO, chair)
Roland Sauerbrey (HZDR)
Emmanuelle Lacaze (CNRS)
Amalia Patanè (University of Nottingham)
Prof. Adam Babiński (University of Warsaw)
Dr. Pierre Védrine (CEA-IRFU, since december 2019)



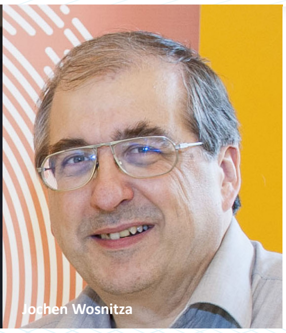
Board of Directors

The board of directors, composed of the laboratory directors, where needed seconded by an executive manager has the following tasks:

- define the vision and mission,
- execute the strategic operation,
- prepare the budget, the annual accounts and the progress report.

The Board of Directors exists of:

Geert Rikken (LNCMI, chair from 02/19)
Jochen Wosnitza (HLD, chair until 02/19)
Peter Christianen (HFML)



Selection Committee

The task of the EMFL selection committee is to ensure that from the proposed experiments only those that are of excellent scientific quality and clearly benefit from the access to a high-field facility are performed in the EMFL facilities.

The Selection Committee evaluates the scientific proposals on the following three criteria:

- scientific quality and originality of the proposal;
- necessity for the use of the infrastructure;
- track record and past performance of the user group.

Xavier Chaud	LNCMI-G	Applied Superconductors
Jens Hänisch	KIT	Applied Superconductors
Andries den Ouden	HFML	Applied Superconductors
Toomas Rõõm	NICPB	Magnetism
Mathias Doerr	IFP	Magnetism
Yuri Skourski	HLD	Magnetism
Uli Zeitler	HFML	Magnetism
Tony Carrington	Univ. Bristol	Metals and Superconductors
Mark Kartsovnik	WMI	Metals and Superconductors
Alix McCollam	HFML	Metals and Superconductors
Ilya Sheikin	LNCMI-G	Metals and Superconductors
Duncan Maude	LNCMI-T	Semiconductors
Amalia Patanè	Univ. Nottingham	Semiconductors
Marek Potemski	LNCMI-G	Semiconductors
Steffen Wiedmann	HFML	Semiconductors
Yves Fautrelle	INP Grenoble	Soft Matter and Magnetoscience
Hans Engelkamp	HFML	Soft Matter and Magnetoscience
Simon Hall	Univ. Bristol	Soft Matter and Magnetoscience

User Committee

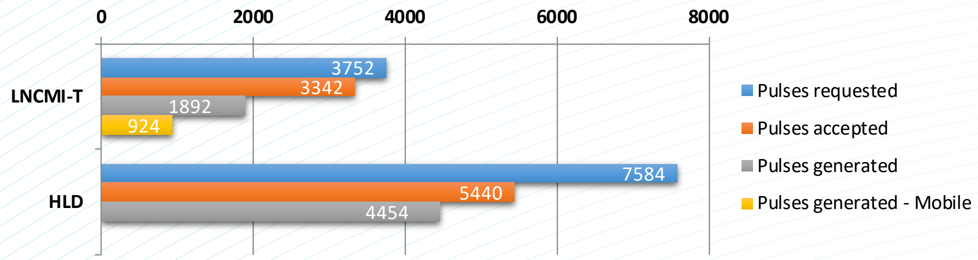
In order to represent the interests of the high-field user community, members (all external to the infrastructures) are elected for a period of three years by the user community during the annual User Meeting. The chairman of the User Committee will report to the Board of Directors on behalf of the users. During the User Meetings the User Committee will report to the users and collect the feedback.

Raivo Stern (Chair)	NICPB, Tallinn	NMR/ESR
Ashish Arora	University of Münster	(Magneto)-optics of 2D semiconductors
Mathias Doerr	TU Dresden	Magnetism
Karel Prokes	Helmholtz-Zentrum Berlin	Magnetism
Carsten Putzke	EPFL	Metals/Superconductors
Antonio Polimeni	Sapienza Università di Roma	Optics/Semiconductors
Alexandre Pourret	IMAPEC-PHELIQS-INAC CEA	Magnetism/Superconductivity
Vassil Skumryev	ICREA, Barcelona	Magnetism/Magnetic materials
Stan Tozer	NHMFL	Magnetism/Superconductivity

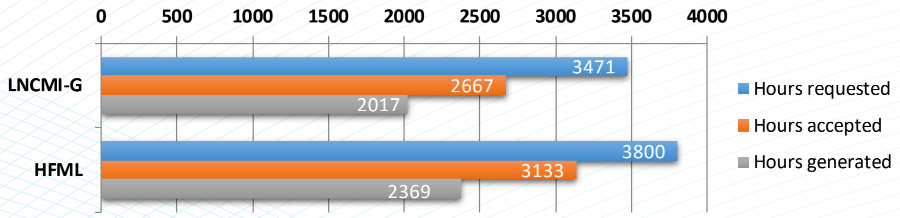
User Access

The 21st and 22nd call for proposals closed in May and November, resulting in 361 applications from 30 different countries in total. The Selection Committee (see page 21) has evaluated the proposals, covering the five types of scientific topics:

- Metals and Superconductors
- Magnetism
- Semiconductors
- Soft Matter and Magnetoscience
- Applied Superconductivity



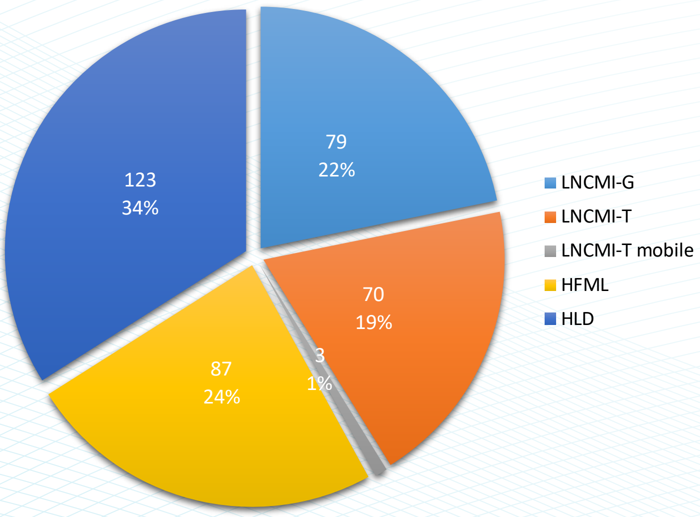
Pulsed facilities



DC facilities

The mobile pulses requested at LNCMI via EMFL at other large scale research infrastructures (ESRF, ILL, ...) are included as well. Access to this can be gained also via the proposal submission procedure of ILL, ESRF etc.

Distribution by facilities
Number of applications

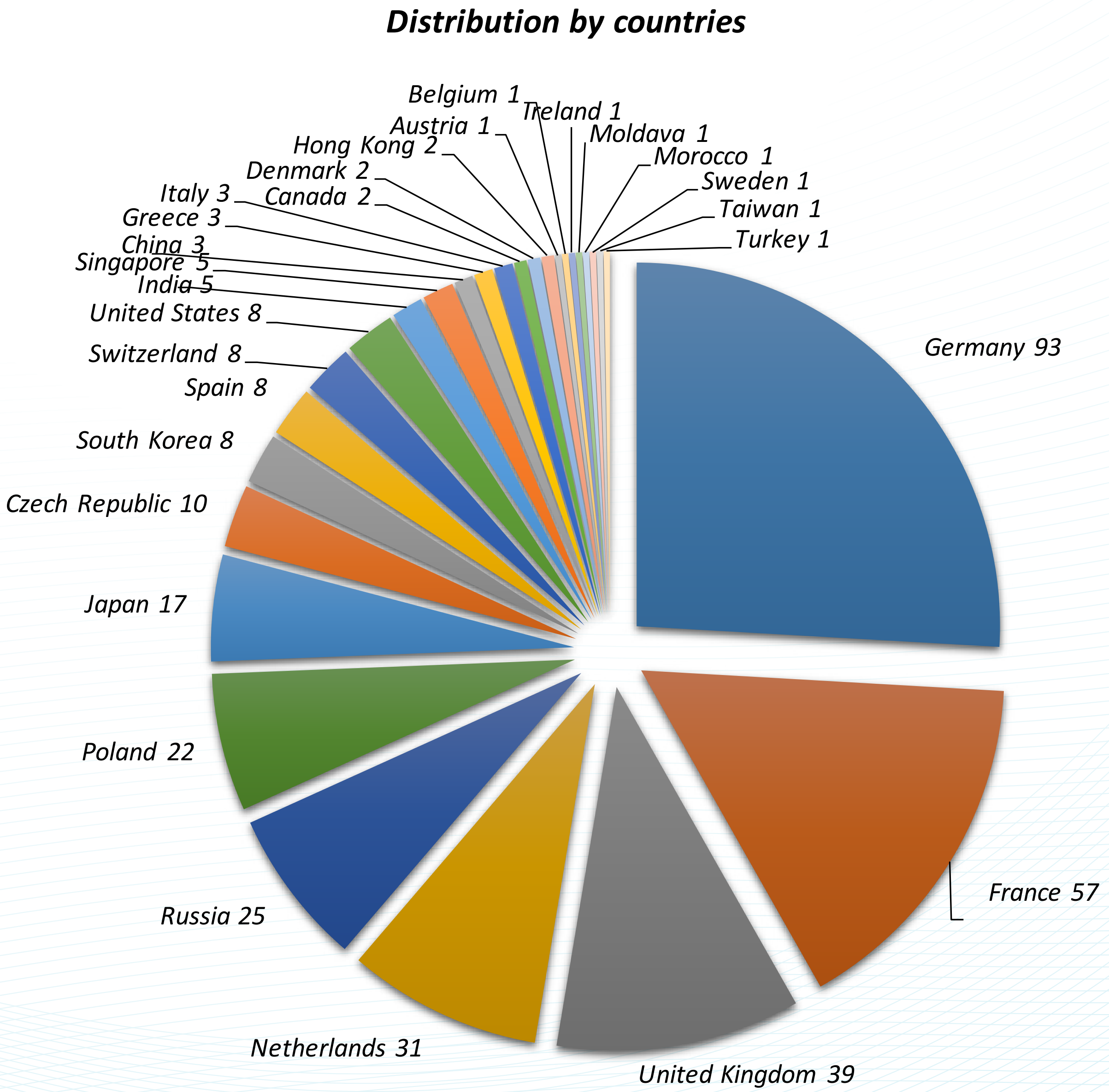


Evaluation of applications

Projects are classified in three categories:
A (excellent proposal to be performed in any case),
B (should be carried out but each facility has some freedom considering other constraints),
C (inadequate 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 freedom within the B category is necessary to allow the facilities to consider other aspects such as for instance available capacity and equipment necessary for a successful project. Besides of ranking the proposals the Selection Committee recommends on the number of accepted magnet hours or number of pulses.

Information about the proposal application procedure can be found at
https://emfl.eu/apply-for-magnet-time/



Publications

Articles 2019

1. Arjun, U., K.M. Ranjith, B. Koo, J. Sichelschmidt, Y. Skourski, M. Baenitz, A.A. Tsirlin and R. Nath (2019). “Singlet ground state in the alternating spin-1/2 chain compound $NaVOAsO_4$”. *Physical Review B*, 99 (1): 014421.

2. Arora, A., M. Koperski, A. Slobodeniuk, K. Nogajewski, R. Schmidt, R. Schneider, M.R. Molas, S.M. de Vasconcellos, R. Bratschitsch and M. Potemski (2019). “Zeeman spectroscopy of excitons and hybridization of electronic states in few-layer WSe_2, $MoSe_2$ and $MoTe_2$”. *2D Materials*, 6 (1): 015010.

3. Artizzu, F., M. Atzori, J. Liu, D. Mara, K. Van Hecke and R. Van Deun (2019). “Solution-processable Yb/Er 2D-layered metallorganic frameworks with high NIR-emission quantum yields”. *J. Mater. Chem. C*, 7: 11207-11214.

4. Atzori, M., I. Breslavetz, K. Paillot, K. Inoue, G.L.J.A. Rikken and C. Train (2019). “A Chiral Prussian Blue Analogue Pushes Magneto-Chiral Dichroism Limits”. *Journal of the American Chemical Society*.

5. Atzori, M. and R. Sessoli (2019). “The Second Quantum Revolution: Role and Challenges of Molecular Chemistry”. *J. Am. Chem. Soc.*, 141 (29): 11339-11352.

6. Averkiev, N.S., I.B. Bersuker, V.V. Gudkov, I.V. Zhevstovskikh, M.N. Sarychev, S. Zherlitsyn, S. Yasin, Y.V. Korostelin and V.T. Surikov (2019). “Ultrasonic Determination of the Jahn–Teller Effect Parameters in Impurity-Containing Crystals”. *Journal of Experimental and Theoretical Physics*, 129 (1): 72-80.

7. Baranov, N.V., N.V. Selezneva, E.M. Sherokalova, Y.A. Baglaeva, A.S. Ovchinnikov, A.A. Tereshchenko, D.I. Gorbunov, A.S. Volegov and A.A. Sherstobitov (2019). “Magnetic phase transitions, metastable states, and magnetic hysteresis in the antiferromagnetic compounds $Fe_{0.5}TiS_{2-y}Se_y$”. *Physical Review B*, 100 (2): 024430.

8. Baranowski, M., K. Galkowski, A. Surrente, J. Urban, L. Klopotowski, S. Mackowski, D.K. Maude, R. Ben Aich, K. Boujdaria, M. Chamarro, C. Testelin, P.K. Nayak, M. Dollmann, H.J. Snaith, R.J. Nicholas and P. Plochocka (2019). “Giant Fine Structure Splitting of the Bright Exciton in a Bulk $MAPbBr_3$ Single Crystal”. *Nano Letters*, 19 (10): 7054-7061.

9. Baranowski, M., S.J. Zelewski, M. Kepenekian, B. Traoré, J.M. Urban, A. Surrente, K. Galkowski, D.K. Maude, A. Kuc, E.P. Booker, R. Kudrawiec, S.D. Stranks and P. Plochocka (2019). “Phase-Transition-Induced Carrier Mass Enhancement in 2D Ruddlesden-Popper Perovskites”. *ACS Energy Letters*, 4 (10): 2386-2392.

10. Barkaoui, H., H. Abid, S. Zelewski, J. Urban, M. Baranowski, A. Mlayah, S. Triki, P. Plochocka and Y. Abid (2019). “Negative Thermal Quenching of Efficient White-Light Emission in a 1D Ladder-Like Organic/Inorganic Hybrid Material”. *Advanced Optical Materials*, 7 (20): 1900763.

11. Barsaume, S., E.A. Mashkovich, K.A. Grishunin, A.V. Telegin, Y.P. Sukhorukov, P.C.M. Christianen, T. Rasing and A.V. Kimel (2019). “Terahertz modulation of the Cotton-Mouton effect”. *J. Physics: Conf. Series*, 1389: 012040.

12. Baryshnikov, K., N. Averkiev, I. Bersuker, V. Gudkov, I. Zhevstovskikh, M. Sarychev, S. Zherlitsyn, S. Yasin and Y. Korostelin (2019). “Interplay Between Relaxation and Resonance in Ultrasound Attenuation by the Cubic Crystal ZnSe:Cr”. *physica status solidi (b)*, 256 (6): 1800635.

13. Barzola-Quiquia, J., P.D. Esquinazi, C.E. Precker, M. Stiller, M. Zoraghi, T. Förster, T. Herrmannsdörfer and W.A. Coniglio (2019). “High-field magnetoresistance of graphite revised”. *Physical Review Materials*, 3 (5): 054603.

14. Bellmann, J., S. Schettler, S. Dittrich, J. Lueg-Althoff, S. Schulze, M. Hahn, E. Beyer and A.E. Tekkaya (2019). “Experimental study on the magnetic pulse welding process of large aluminum tubes on steel rods”. *IOP Conference Series: Materials Science and Engineering*, 480: 012033.

15. Bergk, B., J. Klotz, T. Förster, R. Gumeniuk, A. Leithe-Jasper, V. Lorenz, W. Schnelle, M. Nicklas, H. Rosner, Y. Grin and J. Wosnitza (2019). “Fermi surface studies of the skutterudite superconductors $LaPt_4Ge_{12}$ and $PrPt_4Ge_{12}$”. *Physical Review B*, 99 (24): 245115.

16. Bettler, S., F. Landolt, Ö.M. Aksoy, Z. Yan, S. Gvasaliya, Y. Qiu, E. Ressouche, K. Beauvois, S. Raymond, A.N. Ponomaryov, S.A. Zvyagin and A. Zheludev (2019). “Magnetic structure and spin waves in the frustrated ferro-antiferromagnet $Pb_2VO(PO_4)_2$”. *Physical Review B*, 99 (18): 184437.

17. Bhuiyan, M.A., Z.R. Kudrynskyi, D. Mazumder, J.D.G. Greener, O. Makarovsky, C.J. Mellor, E.E. Vdovin, B.A. Piot, I.I. Lobanova, Z.D. Kovalyuk, M. Nazarova, A. Mishchenko, K.S. Novoselov, Y. Cao, L. Eaves, G. Yusa and A. Patanè (2019). “Photoquantum Hall Effect and Light-Induced Charge Transfer at the Interface of Graphene/InSe Heterostructures”. *Advanced Functional Materials*, 29 (3): 1805491.

18. Binder, J., J. Howarth, F. Withers, M.R. Molas, T. Taniguchi, K. Watanabe, C. Faugeras, A. Wysmolek, M. Danovich, V.I. Fal’ko, A.K. Geim, K.S. Novoselov, M. Potemski and A. Kozikov (2019). “Upconverted electroluminescence via Auger scattering of interlayer excitons in van der Waals heterostructures”. *Nature Communications*, 10 (1): 2335.

19. Birowska, M., J. Urban, M. Baranowski, D.K. Maude, P. Plochocka and N.G. Szwacki (2019). “The impact of hexagonal boron nitride encapsulation on the structural and vibrational properties of few layer black phosphorus”. *Nanotechnology*, 30 (19): 195201.

20. Blosser, D., M. Horvatić, R. Bewley, S. Gvasaliya and A. Zheludev (2019). “Dynamics and field-induced order in the layered spin S=1/2 dimer system $(C_5H_6N_2F)_2CuCl_4$”. *Physical Review Materials*, 3: 074410.

21. Bodnar, S.Y., M. Filianina, S.P. Bommanaboyena, T. Forrest, F. Maccherozzi, A.A. Sapozhnik, Y. Skourski, M. Kläui and M. Jourdan (2019). “Imaging of current induced Néel vector switching in antiferromagnetic Mn_2Au”. *Physical Review B*, 99 (14): 140409.

22. Bolaños, S., J. Béard, G. Revet, S.N. Chen, S. Pikuz, E. Filippov, M. Safronova, M. Cerchez, O. Willi, M. Starodubtsev and J. Fuchs (2019). “Highly-collimated, high-charge and broadband MeV electron beams produced by magnetizing solids irradiated by high-intensity lasers”. *Matter and Radiation at Extremes*, 4 (4): 044401.

23. Bordacs, S., M. Orlita, M. Sikula, H. Murakawa and Y. Tokura (2019). “Limits of validity of the Rashba model in BiTeI: High-field magneto-optical study”. *Physical Review B*, 100 ({15}): 155203.

24. Bovkun, L.S., A.V. Ikonnikov, V.Y. Aleshkin, K.V. Maremyanin, N.N. Mikhailov, S.A. Dvoretskii, S.S. Krishtopenko, F. Teppe, B.A. Piot, M. Potemski, M. Orlita and V.I. Gavrilenko (2019). “Magnetospectroscopy of double HgTe/CdHgTe QWs with inverted band structure in high magnetic fields up to 30 T”. *Opto-Electronics Review*, 27 (2): 213-218.

25. Bovkun, L.S., A.V. Ikonnikov, V.Y. Aleshkin, M. Orlita, M. Potemski, B.A. Piot, S.A. Dvoretskii, N.N. Mikhailov and V.I. Gavrilenko (2019). “Magnetoabsorption in HgCdTe/CdHgTe Quantum Wells in Tilted Magnetic Fields”. *JETP Letters*, 109 (3): 191-197.

26. Bovkun, L.S., V. Ikonnikov, A., V.Y. Aleshkin, K.E. Spirin, I. Gavrilenko, V., N.N. Mikhailov, S.A. Dvoretskii, F. Teppe, B.A. Piot, M. Potemski and M. Orlita (2019). “Landau level spectroscopy of valence bands in HgTe quantum wells: effects of symmetry lowering”. *{Journal of Physics-Condensed Matter}*, 31 (14): 145501.

27. Brodu, A., V. Chandrasekaran, L. Scarpelli, J. Buhot, F. Masia, M.V. Ballottin, M. Severijnen, M.D. Tessier, D. Dupont, F.T. Rabouw, P.C.M. Christianen, C. De Mello Donega, D. Vanmaekelbergh, W. Langbein and Z. Hens (2019). “Fine Structure of Nearly Isotropic Bright Excitons in InP/ZnSe Colloidal Quantum Dots”.

The journal of Physical Chemistry Letters, 10: 5468 - 5475.

28. Brodu, A., M.D. Tessier, D. Canneson, D. Dupont, M.V. Ballottin, P.C.M. Christianen, C. De Mello Donega, Z. Hens, D. Yakovlev, M. Bayer, D. vanmaekelbergh and L. Biadala (2019). “Hyperfine Interactions and Slow Spin Dynamics in Quasi-isotropic InP-based Core/ Shell Colloidal Nanocrystals”. *ACS Nano*, 13: 10201 - 10209.

29. But, D.B., M. Mittendorff, C. Consejo, F. Teppe, N.N. Mikhailov, S.A. Dvoretskii, C. Faugeras, S. Winnerl, M. Helm, W. Knap, M. Potemski and M. Orlita (2019). “Suppressed Auger scattering and tunable light emission of Landau-quantized massless Kane electrons”. *Nature Photonics*, 13 (11): 783-787.

30. Butcher, T.A., J. Hornung, T. Foerster, M. Uhlarz, J. Klotz, I. Sheikin, J. Wosnitza and D. Kaczorowski (2019). “Fermi surface investigation of the semimetal TaAs$_2$”. *Physical Review B*, 99 ({24}): 245112.

31. Butcher, T.A., J. Hornung, T. Förster, M. Uhlarz, J. Klotz, I. Sheikin, J. Wosnitza and D. Kaczorowski (2019). “Fermi surface investigation of the semimetal TaAs$_2$”. *Physical Review B*, 99 (24): 245112.

32. Chattopadhyay, S., B. Lenz, S. Kanungo, Sushila, S.K. Panda, S. Biermann, W. Schnelle, K. Manna, R. Kataria, M. Uhlarz, Y. Skourski, S.A. Zvyagin, A. Ponomaryov, T. Herrmannsdörfer, R. Patra and J. Wosnitza (2019). “Pronounced 2/3 magnetization plateau in a frustrated S=1 isolated spin-triangle compound: Interplay between Heisenberg and biquadratic exchange interactions”. *Physical Review B*, 100 (9): 094427.

33. Chiu, Y.C., K.W. Chen, R. Schönemann, V.L. Quito, S. Sur, Q. Zhou, D. Graf, E. Kampert, T. Förster, K. Yang, G.T. McCandless, J.Y. Chan, R.E. Baumbach, M.D. Johannes and L. Balicas (2019). “Origin of the butterfly magnetoresistance in a Dirac nodal-line system”. *Physical Review B*, 100 (12): 125112.

34. Coldea, A.I., S.F. Blake, S. Kasahara, A.A. Haghighirad, M.D. Watson, W. Knafo, E.S. Choi, A. McCollam, P. Reiss, T. Yamashita, M. Bruma, S.C. Speller, Y. Matsuda, T. Wolf, T. Shibauchi and A.J. Schofield (2019). “Evolution of the low-temperature Fermi surface of superconducting FeSe$_{1-x}$S$_x$ across a nematic phase transition”. *npj Quantum Materials*, 4 (1): 2.

35. Coldea, A.I., S.F. Blake, S. Kasahara, A.A. Haghighirad, M.D. Watson, W. Knafo, E.S. Choi, A. McCollam, P. Reiss, T. Yamashita, M. Bruma, S.C. Speller, Y. Matsuda, T. Wolf, T. Shibauchi and A.J. Schofield (2019). “Evolution of the low-temperature Fermi surface of superconducting FeSe$_{1-x}$S$_x$ across a nematic phase transition”. *njp Quantum Materials*.

36. Córdoba, R., D. Mailly, R.O. Rezaev, E.I. Smirnova, O.G. Schmidt, V.M. Fomin, U. Zeitler, I. Guillamón, H. Suderow and J.M. De Teresa (2019). “Three-Dimensional Superconducting Nanohelices Grown by He$^+$-Focused-Ion-Beam Direct Writing”. *Nano Letters*, 19: 8597 - 8604.

37. Costes, J.-P., G. Novitchi, V. Vieru, L.F. Chibotaru, C. Duhayon, L. Vendier, J.-P. Majoral and W. Wernsdorfer (2019). “Effects of the Exchange Coupling on Dynamic Properties in a Series of CoGdCo Complexes”. *Inorganic Chemistry*, 58 (1): 756-768.

38. Coutinho, J.T., M. Perfetti, J.J. Baldovi, M.A. Antunes, P.P. Hallmen, H. Bamberger, I. Crassee, M. Orlita, M. Almeida, J. van Slageren and L.C.J. Pereira (2019). “Spectroscopic Determination of the Electronic Structure of a Uranium Single-Ion Magnet”. *Chemistry - A European Journal*, 25 (7): 758-1766.

39. Čulo, M·, T· E·, B· Mihaljević, M· Basletić, M· Kuveždić, T· Ivek, A· Hamzić, S· Tomić, T· Hiramatsu, Y· Yoshida, G· Saito, J·A· Schlueter, M· Dressel and B· Korin-Hamzić (2019)· «Hall effect study of the κ-(ET)$_2$X family: evidence for Mott-Anderson localization”. *Physical Review B*, 99: 045114.

40. Das, S.D., S. Kundu, Z. Zhu, E. Mun, R.D. McDonald, G. Li, L. Balicas, A. McCollam, G. Cao, J.G. Rau, H.-Y. Kee, V. Tripathi and S.E. Sebastian (2019). “Magnetic anisotropy of the alkali iridate Na$_2$IrO$_3$ at high magnetic fields: Evidence for strong ferromagnetic Kitaev correlations”. *Physical Review B Rapid Communication*, 99: 081101.

41. Delhomme, A., G. Butseraen, B. Zheng, L. Marty, V. Bouchiat, M.R. Molas, A. Pan, K. Watanabe, T. Taniguchi, A. Ouerghi, J. Renard and C. Faugeras (2019). “Magneto-spectroscopy of exciton Rydberg states in a CVD grown WSe$_2$ monolayer”. *Applied Physics Letters*, 114 (23): 232104.

42. Deng, S., G. Fischer, M. Uhlarz, J. Wosnitza, K.-P. Bohnen, R. Heid, C. Wang and C. Sürgers (2019). “Controlling Chiral Spin States of a Triangular-Lattice Magnet by Cooling in a Magnetic Field”. *Advanced Functional Materials*, 29 (37): 1900947.

43. Devi, P., C.S. Mejía, L. Caron, S. Singh, M. Nicklas and C. Felser (2019). “Effect of chemical and hydrostatic pressure on the coupled magnetostructural transition of Ni-Mn-In Heusler alloys”. *Physical Review Materials*, 3 (12): 122401.

44. Devi, P., C.S. Mejía, M.G. Zavareh, K.K. Dubey, P. Kushwaha, Y. Skourski, C. Felser, M. Nicklas and S. Singh (2019). “Improved magnetostructural and magnetocaloric reversibility in magnetic Ni-Mn-In shape-memory Heusler alloy by optimizing the geometric compatibility condition”. *Physical Review Materials*, 3 (6): 062401.

45. Dixon, I.R., T.A. Adkins, M.D. Bird, M. Hoffmann, J.A.A.J. Perenboom, C.A. Wulffers, A. den Ouden and N.E. Hussey (2019). “Fabrication of the Nb$_3$Sn/Cu CICC Coil and Cold Mass for the Radboud University HFML 45 T Hybrid Magnet “. *IEEE Transactions on Applied Superconductivity*, 29 (5): 4300204.

46. Förster, T., I. Kraft, I. Sheikin, A.D. Bianchi, J. Wosnitza and H. Rosner (2019). “Fermi surface of LaFe$_2$P$_2$ - a detailed density functional study”. *Journal of Physics: Condensed Matter*, 32 (2): 025503.

47. Fries, M., T. Gottschall, F. Scheibel, L. Pfeuffer, K.P. Skokov, I. Skourski, M. Acet, M. Farle, J. Wosnitza and O. Gutfleisch (2019). “Dynamics of the magnetoelastic phase transition and adiabatic temperature change in Mn$_{1.3}$Fe$_{0.7}$P$_{0.5}$Si$_{0.55}$”. *Journal of Magnetism and Magnetic Materials*, 477: 287-291.

48. Frolov, A.V., A.P. Orlov, A.A. Sinchenko and P. Monceau (2019). “Charge density wave sliding driven by an interplay of conventional and Hall voltages in NbSe$_3$ microbridges”. *Physical Review B*, 100: 245126.

49. Galkowski, K., A. Surrente, M. Baranowski, B. Zhao, Z. Yang, A. Sadhanala, S. Mackowski, S.D. Stranks and P. Plochocka (2019). “Excitonic Properties of Low-Band-Gap Lead-Tin Halide Perovskites”. *ACS Energy Letters*, 4 (3): 615-621.

50. Gasparov, V.A., A. Audouard, L. Drigo and J.A. Schlueter (2019). “Temperature Dependence of the Critical Field of the Organic Superconductor k-(BEDT-TTF)2Cu[N(CN)2]Br”. *JETP Letters*, 110 (1): 74-78.

51. Gen, M., T. Nomura, D.I. Gorbunov, S. Yasin, P.T. Cong, C. Dong, Y. Kohama, E.L. Green, J.M. Law, M.S. Henriques, J. Wosnitza, A.A. Zvyagin, V.O. Cheranovskii, R.K. Kremer and S. Zherlitsyn (2019). “Magnetocaloric effect and spin-strain coupling in the spin-nematic state of LiCuVO$_4$”. *Physical Review Research*, 1 (3): 033065.

52. Gorbunov, D.I., I. Ishii, T. Nomura, M.S. Henriques, A.V. Andreev, M. Uhlarz, T. Suzuki, S. Zherlitsyn and J. Wosnitza (2019). “Magnetic phase diagram and crystal-field effects in the kagome-lattice antiferromagnet U$_3$Ru$_4$Al$_{12}$”. *Physical Review B*, 99 (5): 054413.

53. Gorbunov, D.I., T. Nomura, A.A. Zvyagin, M.S. Henriques, A.V. Andreev, Y. Skourski, G.A. Zvyagina, R. Troć, S. Zherlitsyn and J. Wosnitza (2019). “Magnetoelastic coupling across the field-induced transition of uranium mononitride”. *Physical Review B*, 100 (2): 024417.

54. Gorbunov, D.I., C. Strohm, M.S. Henriques, P. van der Linden, B. Pedersen, N.V. Mushnikov, E.V. Rosenfeld, V. Petříček, O. Mathon, J. Wosnitza and A.V. Andreev (2019). “Microscopic Nature of the First-Order Field-Induced Phase Transition in the Strongly Anisotropic Ferrimagnet HoFe$_5$Al$_7$”. *Physical Review Letters*, 122 (12): 127205.

55. Gottschall, T., M.D. Kuz’min, K.P. Skokov, Y. Skourski, M. Fries, O. Gutfleisch, M.G. Zavareh, D.L. Schlagel, Y. Mudryk, V. Pecharsky and J. Wosnitza (2019). “Magnetocaloric effect of gadolinium in high magnetic

fields”. *Physical Review B*, 99 (13): 134429.

56. Gottschall, T., K.P. Skokov, M. Fries, A. Taubel, I. Radulov, F. Scheibel, D. Benke, S. Riegg and O. Gutfleisch (2019). “Making a Cool Choice: The Materials Library of Magnetic Refrigeration”. *Advanced Energy Materials*, 9 (34): 1901322.

57. Gu, T., J.-R. Medy, V. Klosek, O. Castelnau, S. Forest, E. Hervé-Luanco, F. Lecouturier-Dupouy, H. Proudhon, P.-O. Renault, L. Thilly and P. Villechaise (2019). “Multiscale modeling of the elasto-plastic behavior of architectured and nanostructured Cu-Nb composite wires and comparison with neutron diffraction experiments”. *International Journal of Plasticity*.

58. Guchhait, S., U. Arjun, P.K. Anjana, M. Sahoo, A. Thirumurugan, A. Medhi, Y. Skourski, B. Koo, J. Sichelschmidt, B. Schmidt, M. Baenitz and R. Nath (2019). “Case study of bilayered spin-1/2 square lattice compound VO(HCOO)$_2$⍰(H$_2$O)“. *Physical Review Materials*, 3 (10): 104409.

59. Haindl, S., E. Kampert, M. Sasase, H. Hiramatsu and H. Hosono (2019). “Low anisotropic upper critical fields in SmO$_{1-x}$ F$_x$ FeAs thin films with a layered hybrid structure”. *Superconductor Science and Technology*, 32 (4): 044003.

60. Hartman, M.T., R. Battesti and C. Rizzo (2019). “Characterization of the Vacuum Birefringence Polarimeter at BMV: Dynamical Cavity Mirror Birefringence”. *IEEE Transactions on Instrumentation and Measurement*, 68 (6): 2268-2273.

61. Hayashida, S., D. Blosser, K.Y. Povarov, Z. Yan, S. Gvasaliya, A.N. Ponomaryov, S.A. Zvyagin and A. Zheludev (2019). “One- and three-dimensional quantum phase transitions and anisotropy in Rb$_2$ Cu$_2$ Mo$_3$ O$_{12}$”. *Physical Review B*, 100 (13): 134427.

62. He, Y., J. Li, L. Li, J. Wang, E. Yildiz and E. Beaugnon (2019). “Composition dependent characteristic transition temperatures of Co-B melts”. *Journal of Non-Crystalline Solids*, 522: 119583.

63. He, Y., J. Li, J. Wang, E. Yildiz, S. Pairis and E. Beaugnon (2019). “Temperature-induced structure transition in a liquid Co-B eutectic alloy”. *Materials Letters*, 234: 351.

64. Higginson, D.P., P. Korneev, C. Ruyer, R. Riquier, Q. Moreno, J. Béard, S.N. Chen, A. Grassi, M. Grech, L. Gremillet, H. Pépin, F. Perez, S. Pikuz, B. Pollock, C. Riconda, R. Shepherd, M. Starodubtsev, V. Tikhonchuk, T. Vinci, E. d’Humières and J. Fuchs (2019). “Laboratory investigation of particle acceleration and magnetic field compression in collisionless colliding fast plasma flows”. *Communications Physics*, 2 (1): 60.

65. Hussey, N.E. (2019). “The Allure of Linearity “. *Fields Science, Discovery & Magnetism*, Spring 2019.

66. Ibrahim, M., S. Krämer, N. Schork and G. Guthausen (2019). “Polyoxometalate-based high-spin cluster systems: a NMR relaxivity study up to 1.4 GHz/33 T”. *Dalton Transactions*, 48: 15597-15604.

67. Jakobsen, V.B., L. O’Brien, G. Novitchi, H. Müller-Bunz, A.-L. Barra and G.G. Morgan (2019). “Chiral Resolution of a Mn^{3+} Spin Crossover Complex”. *European Journal of Inorganic Chemistry* (0).

68. Jiao, L., M. Smidman, Y. Kohama, Z.S. Wang, D. Graf, Z.F. Weng, Y.J. Zhang, A. Matsuo, E.D. Bauer, H. Lee, S. Kirchner, J. Singleton, K. Kindo, J. Wosnitza, F. Steglich, J.D. Thompson and H.Q. Yuan (2019). “Enhancement of the effective mass at high magnetic fields in CeRhIn$_5$”. *Physical Review B*, 99 (4): 045127.

69. Juraszek, J., L. Bochenek, A. Rudenko, M.M. Hosen, M. Daszkiewicz, Z. Wang, J. Wosnitza, Z. Henkie, M. Samsel-Czekała, M. Neupane and T. Cichorek (2019). “Nonsaturating extreme magnetoresistance and large electronic magnetostriction in LuAs”. *Physical Review Research*, 1 (3): 032016.

70. Kazimierczuk, T., A. Bogucki, T. Smolenski, M. Goryca, C. Faugeras, P. Machnikowski, M. Potemski and P. Kossacki (2019). “Time-resolved magneto-Raman study of carrier dynamics in low Landau levels of graphene”. *Physical Review B*, 100 ({7}): 075401.

71. Keshavarz, M., M. Ottesen, S. Wiedmann, M. Wharmby, R. Küchler, H. Yuan, E. Debroye, J.A. Steele, J. Martens, N.E. Hussey, M. Bremholm, M.B.J. Roeffaers and J. Hofkens (2019). “Tracking Structural Phase Transitions in Lead-Halide Perovskites by Means of Thermal Expansion”. *Advanced Materials*, 31: 1900521.

72. Khan, N., D. Prishchenko, Y. Skourski, V.G. Mazurenko and A.A. Tsirlin (2019). “Cubic symmetry and magnetic frustration on the fcc spin lattice in K_2IrCl_6”. *Physical Review B*, 99 (14): 144425.

73. Khanna, U., P.K. Rout, M. Mograbi, G. Tuvia, I. Leermakers, U. Zeitler, Y. Dagan and M. Goldstein (2019). “Symmetry and Correlation Effects on Band Structure Explain the Anomalous Transport Properties of (111) $LaAlO_3$ / $SrTiO_3$”. *Physical Review Letters*, 123: 036805.

74. Khiar, B., G. Revet, A. Ciardi, K. Burdonov, E. Filippov, J. Béard, M. Cerchez, S.N. Chen, T. Gangolf, S.S. Makarov, M. Ouillé, M. Safronova, I.Y. Skobelev, A. Soloviev, M. Starodubtsev, O. Willi, S. Pikuz and J. Fuchs (2019). “Laser-Produced Magnetic-Rayleigh-Taylor Unstable Plasma Slabs in a 20 T Magnetic Field”. *Physical Review Letters*, 123: 205001.

75. Khouri, T., S. Pezzini, M. Bendias, P. Leubner, U. Zeitler, N.E. Hussey, H. Buhmann, L.W. Molenkamp, M. Titov and S. Wiedmann (2019). “Magnetoresistance in the in-plane magnetic field induced semimetallic phase of inverted HgTe quantum wells”. *Physical Review B*, 99: 075303.

76. Klotz, J., K. Götze, T. Förster, J.A.N. Bruin, J. Wosnitza, K. Weber, M. Schmidt, W. Schnelle, C. Geibel, U.K. Rößler and H. Rosner (2019). “Electronic band structure and proximity to magnetic ordering in the chiral cubic compound CrGe”. *Physical Review B*, 99: 085130.

77. Klotz, J., K. Götze, V. Lorenz, Y. Prots, H. Rosner, H. Harima, L. Bochenek, Z. Henkie, T. Cichorek, I. Sheikin and J. Wosnitza (2019). “Fermi surface investigation of the filled skutterudite $LaRu_4As_{12}$”. *Physical Review B*, 100: 205106.

78. Knafo, W., T.D. Matsuda, F. Hardy, D. Aoki and J. Flouquet (2019). “High-field moment polarization in the itinerant ferromagnet URhSi”. *Physical Review B*, 100: 094421.

79. Knafo, W., M. Valiska, D. Braithwaite, G. Lapertot, G. Knebel, A. Pourret, J.-P. Brison, J. Flouquet and D. Aoki (2019). “Magnetic-Field-Induced Phenomena in the Paramagnetic Superconductor UTe_2”. *Journal of the Physical Society of Japan*, 88 (6): 063705.

80. Knebel, G., W. Knafo, A. Pourret, Q. Niu, M. Valiska, D. Braithwaite, G. Lapertot, M. Nardone, A. Zitouni, S. Mishra, I. Sheikin, G. Seyfarth, J.-P. Brison, D. Aoki and J. Flouquet (2019). “Field-Reentrant Superconductivity Close to a Metamagnetic Transition in the Heavy-Fermion Superconductor UTe_2”. *Journal of the Physical Society of Japan*, 88 (6): 063707.

81. Koperski, M., M.R. Molas, A. Arora, K. Nogajewski, M. Bartos, J. Wyzula, D. Vaclavkova, P. Kossacki and M. Potemski (2019). “Orbital, spin and valley contributions to Zeeman splitting of excitonic resonances in $MoSe_2$, WSe_2 and WS_2 Monolayers”. *2D Materials*, 6 (1): 015001.

82. Krasnikova, Y.V., V.N. Glazkov, A. Ponomaryov, S.A. Zvyagin, K.Y. Povarov, S. Galeski and A. Zheludev (2019). “Electron spin resonance study of spin relaxation in the strong-leg spin ladder with nonmagnetic dilution”. *Physical Review B*, 100 (14): 144446.

83. Krieg, J., R. Giraud, H. Funke, J. Dufouleur, W. Escoffier, C. Trautmann and M.E. Toimil-Molares (2019). “Magnetotransport measurements on Bi_2Te_3 nanowires electrodeposited in etched ion-track membranes”. *Journal of Physics and Chemistry of Solids*, 128: 360.

84. Król, M., K. Lekenta, A. Mirek, K. Lempicka, D. Stephan, K. Nogajewski, M.R. Molas, A. Babinski, M. Potemski, J. Szczytko and B. Pietka (2019). “Valley polarization of exciton-polaritons in monolayer WSe_2 in a tunable microcavity”. *NANOSCALE*, 11 (19): 9574-9579.

85. Król, M., K. Rechcińska, K. Nogajewski, M. Grzeszczyk, K. Łempicka, R. Mirek, S. Piotrowska, K.

Watanabe, T. Taniguchi, M.R. Molas, M. Potemski, J. Szczytko and B. Pietka (2019). “Exciton-polaritons in multilayer WSe_2 in a planar microcavity”. *2D Materials*, 7 (1): 015006.

86. Kumar, N., Y. Sun, M. Nicklas, S.J. Watzman, O. Young, I. Leermakers, J. Hornung, J. Klotz, J. Gooth, K. Manna, V. Süß, S.N. Guin, T. Förster, M. Schmidt, L. Muechler, B. Yan, P. Werner, W. Schnelle, U. Zeitler, J. Wosnitza, S.P. Parkin, C. Felser and C. Shekhar (2019). “Extremely high conductivity observed in the triple point topological metal MoP”. *Nature Communications*, 10: 2475.

87. Kumar, N., Y. Sun, M. Nicklas, S.J. Watzman, O. Young, I. Leermakers, J. Hornung, J. Klotz, J. Gooth, K. Manna, V. Süß, S.N. Guin, T. Förster, M. Schmidt, L. Muechler, B. Yan, P. Werner, W. Schnelle, U. Zeitler, J. Wosnitza, S.S.P. Parkin, C. Felser and C. Shekhar (2019). “Extremely high conductivity observed in the triple point topological metal MoP”. *Nature Communications*, 10 (1): 2475.

88. Kurka, M., M. Dyksik, W. Golletz, M. Środa, V.V.e. Romanov, K.D. Moiseev and M. Motyka (2019). “Features of carrier confinement in InAsSb(P) alloys and quantum wells for room-temperature operating mid-infrared emitters”. *Applied Physics Express*, 12 (11): 115504.

89. Legros, A., S. Benhabib, W. Tabis, F. Laliberté, M. Dion, M. Lizaire, B. Vignolle, D. Vignolles, H. Raffy, Z.Z. Li, P. Auban-Senzier, N. Doiron-Leyraud, P. Fournier, D. Colson, L. Taillefer and C. Proust (2019). “Universal T-linear resistivity and Planckian dissipation in overdoped cuprates”. *Nature Physics*, 15: 142.

90. Licciardello, S., J. Buhot, J. Lu, J. Ayres, S. Kasahara, Y. Matsuda, T. Shibauchi and N.E. Hussey (2019). “Electrical resistivity across a nematic quantum critical point “. *Nature*, 567: 213-217.

91. Licciardello, S., N. Maksimovic, J. Ayres, J. Buhot, M. Čulo, B. Bryant, S. Kasahara, Y. Matsuda, T. Shibauchi, V. Nagarajan, J.G. Analytis and N.E. Hussey (2019). “Coexistence of orbital and quantum critical magnetoresistance in $FeSe_{1-x}S_x$”. *Physical Review Research*, 1: 023011.

92. Liebfried, O., S. Hundertmark and P. Frings (2019). “Inductive Pulsed Power Supply for a Railgun Artillery System”. *IEEE Transactions on Plasma Science*, 47 (5): 2550-2555.

93. Lin, B.-C., S. Wang, S. Wiedmann, J.-M. Lu, W.-Z. Zheng, D. Yu and Z.-M. Liao (2019). “Observation of an Odd-Integer Quantum Hall Effect from Topological Surface States in Cd_3As_2”. *Physical Review Letters*, 122: 036602.

94. Lin, J., T. Han, B.A. Piot, Z. Wu, S. Xu, G. Long, L. An, P. Cheung, P.-P. Zheng, P. Plochocka, X. Dai, D.K. Maude, F. Zhang and N. Wang (2019). “Determining Interaction Enhanced Valley Susceptibility in Spin-Valley-Locked MoS_2”. *Nano Letters*, 19 (3): 1736-1742.

95. Loret, B., N. Auvray, Y. Gallais, M. Cazayous, A. Forget, D. Colson, M.H. Julien, I. Paul, M. Civelli and A. Sacuto (2019). “Intimate link between charge density wave, pseudogap and superconducting energy scales in cuprates”. *Nature Physics*, 15 ({8}): 771-775.

96. Lu, J., X. Xu, M. Greenblatt, R. Jin, P. Tinnemans, S. Licciardello, M.R. van Delft, J. Buhot, P. Chudzinski and N.E. Hussey (2019). “Emergence of a real-space symmetry axis in the magnetoresistance of the one-dimensional conductor $Li_{0.9}Mo_6O_{17}$ “. *Science Advances*, 5 (7): eaar8027

97. Majumder, M., F. Freund, T. Dey, M. Prinz-Zwick, N. Büttgen, Y. Skourski, A. Jesche, A.A. Tsirlin and P. Gegenwart (2019). “Anisotropic temperature-field phase diagram of single crystalline β - Li_2IrO_3: Magnetization, specific heat, and ^{7}Li NMR study”. *Physical Review Materials*, 3 (7): 074408.

98. Mansouri, S., S. Jandl, M. Balli, P. Fournier, Y. Ishii, H. Kimura, M. Orlita and M. Chaker (2019). “Origin of the enhanced ferroelectricity in multiferroic $SmMn_2O_5$”. *Physical Review B*, 100 ({8}): 085147.

99. Maraytta, N., Y. Skourski, J. Voigt, K. Friese, M.G. Herrmann, J. Perßon, J. Wosnitza, S.M. Salman and T. Brückel (2019). “Direct measurements of the magneto-caloric effect of $MnFe_4Si_3$ in pulsed magnetic fields”. *Journal of Alloys and Compounds*, 805: 1161-1167.

100. Marchou, P., R. Mathevet, É. Jammes, C. Fabre, N. Lamrani, S. Martin, J.-P. Castro and S. Staacks (2019).

“Une approche quantitative de la loi de Beer-Lambert avec un smartphone - Premiere partie”. *Bulletin de l’Union des Physiciens*, 113: 1079.

101. Martino, E., I. Crassee, G. Eguchi, D. Santos-Cottin, R.D. Zhong, G.D. Gu, H. Berger, Z. Rukelj, M. Orlita, C.C. Homes and A. Akrap (2019). “Two-Dimensional Conical Dispersion in $ZrTe_5$ Evidenced by Optical Spectroscopy”. *Physical Review Letters*, 122 ({21}): 217402.

102. Mashkovich, E.A., K.A. Grishunin, R.V. Mikhaylovskiy, A.K. Zvezdin, R.V. Pisarev, M.B. Strugatsky, P.C.M. Christianen, T. Rasing and A.V. Kimel (2019). “Terahertz Optomagnetism: Nonlinear THz Excitation of GHz Spin Waves in Antiferromagnetic $FeBO_3$”. *Physical Review Letters*, 123: 157202.

103. Mašková, S., A.V. Andreev, Y. Skourski, S. Yasin, D.I. Gorbunov, S. Zherlitsyn, H. Nakotte, K. Kothapalli, F. Nasreen, C. Cupp, H.B. Cao, A. Kolomiets and L. Havela (2019). “$U_2 Ni_2 Sn$ and the origin of magnetic anisotropy in uranium compounds”. *Physical Review B*, 99 (6): 064415.

104. Mathevet, R., E. Jammes, C. Fabre, N. Lamrani, S. Martin, J.-P. Castro, P. Marchou and S. Staacks (2019). “Une approche quantitative de la loi de Beer-Lambert avec un smartphone - Seconde partie”. *Bulletin de l’Union des Physiciens*, 113: 1357.

105. Mentink-Vigier, F., A.-L. Barra, J. van Tol, S. Hediger, D. Lee and G. De Paepe (2019). “De novo prediction of cross-effect efficiency for magic angle spinning dynamic nuclear polarization”. *Physical Chemistry Chemical Physics*, 21 (4): 2166-2176.

106. Mitioglu, A., S. Anghel, M.V. Ballottin, K. Sushkevich, L. Kulyuk and P.C.M. Christianen (2019). “Anomalous rotation of the linearly polarized emission of bright excitons in strained WSe_2 monolayers under high magnetic fields”. *Physical Review B*, 99: 155414.

107. Molas, M.R., K. Golasa, L. Bala, K. Nogajewski, M. Bartos, M. Potemski and A. Babinski (2019). “Tuning carrier concentration in a superacid treated MoS_2 monolayer”. *Scientific Reports*, 9: 1989.

108. Molas, M.R., A.O. Slobodeniuk, T. Kazimierczuk, K. Nogajewski, M. Bartos, P. Kapuscinski, K. Oreszczuk, K. Watanabe, T. Taniguchi, C. Faugeras, P. Kossacki, D.M. Basko and M. Potemski (2019). “Probing and Manipulating Valley Coherence of Dark Excitons in Monolayer WSe_2”. *Physical Review Letters*, 123 ({9}): 096803.

109. Molas, M.R., A.O. Slobodeniuk, K. Nogajewslci, M. Bartos, L. Bala, A. Babinski, K. Watanabe, T. Taniguchi, C. Faugeras and M. Potemski (2019). “Energy Spectrum of Two-Dimensional Excitons in a Nonuniform Dielectric Medium”. *Physical Review Letters*, 123 ({13}): 136801.

110. Monteiro, A.M.R.V.L., M. Vivek, D. Groenendijk, P. Bruneel, I. Leermakers, U. Zeitler, M. Gabay and A. Caviglia (2019). “Band inversion driven by electronic correlations at the (111) $LaAlO_3/SrTiO_3$ interface”. *Physical Review B*, 99: 201102(R).

111. Mukharjee, P.K., K.M. Ranjith, B. Koo, J. Sichelschmidt, M. Baenitz, Y. Skourski, Y. Inagaki, Y. Furukawa, A.A. Tsirlin and R. Nath (2019). “Bose-Einstein condensation of triplons close to the quantum critical point in the quasi-one-dimensional spin-1/2 antiferromagnet Na $VOPO_4$”. *Physical Review B*, 100 (14): 144433.

112. Nagler, P., F. Mooshammer, J. Kunstmann, M.V. Ballottin, A. Mitioglu, A. Chernikov, A. Chaves, F. Stein, N. Paradiso, S. Meier, G. Plechinger, C. Strunk, R. Huber, G. Seifert, D.R. Reichman, P.C.M. Christianen, C. Schüller and T. Korn (2019). “Interlayer Excitons in Transition-Metal Dichalcogenide Heterobilayers”. *Physica Status Solidi (b)*, 2019: 1900308.

113. Nguyen, T., A. Tavakoli, S. Triqueneaux, R. Swami, A. Ruhtinas, J. Gradel, P. Garcia-Campos, K. Hasselbach, A. Frydman, B. Piot, M. Gibert, E. Collin and O. Bourgeois (2019). “Niobium Nitride Thin Films for Very Low Temperature Resistive Thermometry”. *Journal of Low Temperature Physics*, 197 (5): 348-356.

114. Nomura, T., X.X. Zhang, S. Zherlitsyn, J. Wosnitza, Y. Tokura, N. Nagaosa and S. Seki (2019). “Phonon Magnetochiral Effect”. *Physical Review Letters*, 122 (14): 145901.

115. Nomura, T., S. Zherlitsyn, Y. Kohama and J. Wosnitza (2019). “Viscosity measurements in pulsed magnetic fields by using a quartz-crystal microbalance”. *Review of Scientific Instruments*, 90 (6): 065101.

116. Opherden, L., T. Herrmannsdörfer, M. Uhlarz, D.I. Gorbunov, A. Miyata, O. Portugall, I. Ishii, T. Suzuki, H. Kaneko, H. Suzuki and J. Wosnitza (2019). “Magnetization beyond the Ising limit of $Ho_2Ti_2O_7$”. *Physical Review B*, 99 (8): 085132.

117. Ovchenkova, I.A., I.S. Tereshina, A.E. Bogdanov, E.A. Tereshina-Chitrova, M.A. Paukov, D.I. Gorbunov and S.A. Nikitin (2019). “The tremendous influence of hydrogenation on magnetism of NdMnGe”. *Intermetallics*, 115: 106619.

118. Palamarciuc, O., M.N.M. Milunovic, A. Sirbu, E. Stratulat, A. Pui, N. Gligorijevic, S. Radulovic, J. Kozisek, D. Darvasiova, P. Rapta, E.A. Enyedy, G. Novitchi, S. Shova and V.B. Arion (2019). “Investigation of the cytotoxic potential of methyl imidazole-derived thiosemicarbazones and their copper(II) complexes with dichloroacetate as a co-ligand”. *New Journal of Chemistry*, 43 (3): 1340-1357.

119. Pandya, R., V. Steinmetz, Y. Puttisong, M. Dufour, W.M. Chen, R.Y.S. Chen, T. Barisien, A. Sharma, G. Lakhwani, A. Mitioglu, P.C.M. Christianen, L. Legrand, F. Bernardot, C. Testelin, A.W. Chin, S. Ithurria, M. Chamarro and A. Rao (2019). “Fine Structure and Spin Dynamics of Linearly Polarized Indirect Excitons in Two- Dimensional CdSe/CdTe Colloidal Heterostructures”. *ACS Nano*, 13: 10140 - 10153.

120. Paukov, M.A., L.A. Ivanov, D.I. Gorbunov and I.S. Tereshina (2019). “Magnetic and Magnetothermal Properties of Hydrogenated Materials Based on Rare Earths and Iron”. *IEEE Magnetics Letters*, 10: 1-5.

121. Peedu, L., V. Kocsis, D. Szaller, J. viirok, U. Nagel, T. Rõõm, D.G. Farkas, S. Bordács, D. Kamenskyi, U. Zeitler, Y. Tokunaga, Y. Taguchi, Y. Tokura and I. Kézsmárki (2019). “Spin excitations of magnetoelectric $LiNiPO_4$ in multiple magnetic phases”. *Physical Review B Editor’s Suggestion*, 100: 024406.

122. Perfetti, M., M. Gysler, Y. Rechkemmer-Patalen, P. Zhang, H. Tastan, F. Fischer, J. Netz, W. Frey, L.W. Zimmermann, T. Schleid, M. Hakl, M. Orlita, L. Ungur, L. Chibotaru, T. Brock-Nannestad, S. Piligkos and J. van Slageren (2019). “Determination of the electronic structure of a dinuclear dysprosium single molecule magnet without symmetry idealization”. *{Chemical Science}*, 10 ({11}): 3429.

123. Pezzini, S., S. Wiedmann, A. Mishchenko, M. Holwill, R. Gorbachev, D. Ghazaryan, K.S. Novoselov and U. Zeitler (2019). “Field-induced insulating states in a graphene superlattice”. *Physical Review B, Editor’s Suggestion*, 99: 045440.

124. Pierre, M., S.R. Sathyamoorthy, I.-M. Svensson, G. Johansson and P. Delsing (2019). “Resonant and off-resonant microwave signal manipulation in coupled superconducting resonators”. *Physical Review B*, 99: 094518.

125. Pogrebna, A., K. Prabhakara, M. Davydova, B. Becker, A. Tsukamoto, T. Rasing, A. Kirilyuk, A.K. Zvezdin, P.C.M. Christianen and A.V. Kimel (2019). “High-field anomalies of equilibrium and ultrafast magnetism in rare-earth–transition-metal ferrimagnets”. *Physical Review B*, 100: 174427.

126. Prokeš, K., T. Förster, Y.K. Huang and J.A. Mydosh (2019). “Field-induced phases in a heavy-fermion $U(Ru_{0.92}Rh_{0.08})_2Si_2$ single crystal”. *Physical Review B*, 99 (4): 045104.

127. Proust, C. and L. Taillefer (2019). “The Remarkable Underlying Ground States of Cuprate Superconductors”. *Annual Review of Condensed Matter Physics*, 10 (1): 409-429.

128. Ranjith, K.M., D. Dmytriieva, S. Khim, J. Sichelschmidt, S. Luther, D. Ehlers, H. Yasuoka, J. Wosnitza, A.A. Tsirlin, H. Kühne and M. Baenitz (2019). “Field-induced instability of the quantum spin liquid ground state in the $J_{eff} = 1/2$ triangular-lattice compound $NaYbO_2$”. *Physical Review B*, 99 (18): 180401.

129. Ranjith, K.M., S. Luther, T. Reimann, B. Schmidt, P. Schlender, J. Sichelschmidt, H. Yasuoka, A.M. Strydom, Y. Skourski, J. Wosnitza, H. Kühne, T. Doert and M. Baenitz (2019). “Anisotropic field-induced ordering in the triangular-lattice quantum spin liquid $NaYbSe_2$”. *Physical Review B*, 100 (22): 224417.
130. Reiss, P., D. Graf, A.A. Haghighirad, W. Knafo, L. Drigo, M. Bristow, A.J. Schofield and A.I. Coldea (2019). “Quenched nematic criticality and two superconducting domes in an iron-based superconductor”. *Nature Physics*.
131. Revet, G., B. Khiar, J. Béard, R. Bonito, S. Orlando, M.V. Starodubtsev, A. Ciardi and J. Fuchs (2019). “Laser experiment for the study of accretion dynamics of Young Stellar Objects: Design and scaling”. *High Energy Density Physics*, 33: 100711.
132. Rikken, G.L.J.A. and N. Avarvari (2019). “Strong electrical magnetochiral anisotropy in tellurium”. *Physical Review B*, 99: 245153.
133. Rossi, L., A. Bobel, S. Wiedmann, R. Küchler, Y. Motome, K. Penc, N. Shannon, H. Ueda and B. Bryant (2019). “Negative Thermal Expansion in the Plateau State of a Magnetically Frustrated Spinel”. *Physical Review Letters*, 123: 027205.
134. Rößler, S., C. Koz, Z. Wang, Y. Skourski, M. Doerr, D. Kasinathan, H. Rosner, M. Schmidt, U. Schwarz, U.K. Rößler and S. Wirth (2019). “Two types of magnetic shape-memory effects from twinned microstructure and magneto-structural coupling in $Fe_{1+y}Te$”. *Proceedings of the National Academy of Sciences*, 116 (34): 16697-16702.
135. Rudokas, V., N. Žurauskienė, R. Lukošė, S. Keršulis, V. Stankevič, D. Pavilonis, S. Balevičius, V. Plaušinaitienė, M. Vagner, M. Skapas and S. Arsenijevic (2019). “La–Sr–Mn–Co–O Films for High Pulsed Magnetic Field Measurements at Cryogenic Temperatures”. *IEEE Transactions on Plasma Science*, 47 (10): 4541-4546.
136. Ruff, A., Z. Wang, S. Zherlitsyn, J. Wosnitza, S. Krohns, H.-A. Krug von Nidda, P. Lunkenheimer, V. Tsurkan and A. Loidl (2019). “Multiferroic spin-superfluid and spin-supersolid phases in $MnCr_2S_4$”. *Physical Review B*, 100 (1): 014404.
137. Salazar-Mejía, C., V. Kumar, C. Felser, Y. Skourski, J. Wosnitza and A.K. Nayak (2019). “Measurement-Protocol Dependence of the Magnetocaloric Effect in Ni-Co-Mn}-Sb Heusler Alloys”. *Physical Review Applied*, 11 (5): 054006.
138. Schulze, E., S. Arsenijevic, L. Opherden, A.N. Ponomaryov, J. Wosnitza, T. Ono, H. Tanaka and S.A. Zvyagin (2019). “Evidence of one-dimensional magnetic heat transport in the triangular-lattice antiferromagnet Cs_2CuCl_4”. *Physical Review Research*, 1 (3): 032022.
139. Shishkin, D.A., A.S. Volegov, V.V. Ogloblichev, K.N. Mikhalev, E.G. Gerasimov, P.B. Terentev, V.S. Gaviko, D.I. Gorbunov and N.V. Baranov (2019). “Effect of Tb for Gd substitution on magnetic and magnetocaloric properties of melt-spun $(Gd_{1-x}Tb_x)_3Co$ alloys”. *Intermetallics*, 104: 1-7.
140. Simonet, V., F. Damay, S. Ferlay, A. Cea, C. Maxim and C. Train (2019). “Magnetic Investigation of an Atypical Three-Dimensional Bimetallic Oxalate-Based Magnet”. *J. Phys. Chem. C*.
141. Skvortsov, A., D. Pshonkin, E. Kunitsyna, R. Morgunov and E. Beaugnon (2019). “Softening of the Al-Mg-Si-Fe alloy under magnetostriction of FeAl microinclusions”. *Journal of Applied Physics*, 125 (2): 023903.
142. Slater-Parry, M.E., J.P. Durrant, J.M. Howells, M.B. Pitak, P.N. Horton, W.T. Klooster, S.J. Coles, H.M. O’Connor, E.K. Brechin, A.-L. Barra and L.F. Jones (2019). “Crowding out: ligand modifications and their structure directing effects on brucite-like M-x((3)-OH)(y)} (M = Co(ii), Ni(ii)) core growth within polymetallic cages”. *Dalton Transactions*, 48 ({4}): 1477-1488.
143. Slobodeniuk, A.O., L. Bala, M. Koperski, M.R. Molas, P. Kossacki, K. Nogajewski, M. Bartos, K. Watanabe, T. Taniguchi, C. Faugeras and M. Potemski (2019). “Fine structure of K-excitons in

multilayers of transition metal dichalcogenides”. *2D Materials*, 6 ({2}): 025026.

144. Soh, J.-R., F. de Juan, M.G. Vergniory, N.B.M. Schröter, M.C. Rahn, D.Y. Yan, J. Jiang, M. Bristow, P.A. Reiss, J.N. Blandy, Y.F. Guo, Y.G. Shi, T.K. Kim, A. McCollam, S.H. Simon, Y. Chen, A.I. Coldea and A.T. Boothroyd (2019). “Ideal Weyl semimetal induced by magnetic exchange”. *Physical Review B Editor’s Suggestion*, 100: 201102(R).

145. Song, J.-B., X. Chaud, B. Borgnic, F. Debray, P. Fazilleau and T. Lecrevisse (2019). “Construction and Test of a 7 T Metal-as-Insulation HTS Insert Under a 20 T High Background Magnetic Field at 4.2 K”. *IEEE Transactions on Applied Superconductivity*, 29 (5): 4601705.

146. Soubelet, P., A.A. Reynoso, A. Fainstein, K. Nogajewski, M. Potemski, C. Faugeras and A.E. Bruchhausen (2019). “The lifetime of interlayer breathing modes of few-layer 2H-MoSe$_2$ membranes”. *Nanoscale*, 11 ({21}): 10446-10453.

147. Stavrakas, C., S.J. Zelewski, K. Frohna, E.P. Booker, K. Galkowski, K. Ji, E. Ruggeri, S. Mackowski, R. Kudrawiec, P. Plochocka and S.D. Stranks (2019). “Influence of Grain Size on Phase Transitions in Halide Perovskite Films”. *Advanced Energy Materials*, 9 (35): 1901883.

148. Stöter, T., M. Antlauf, L. Opherden, T. Gottschall, J. Hornung, J. Gronemann, T. Herrmannsdörfer, S. Granovsky, M. Schwarz, M. Doerr, H.H. Klauss, E. Kroke and J. Wosnitza (2019). “Tuning the interactions in the spin-ice materials Dy$_2$Ge$_{2-x}$Si$_x$O$_7$ by silicon substitution”. *Physical Review B*, 100 (5): 054403.

149. Sulc, M., P. Pugnat, R. Ballou, G. Deferne, J. Hosek, S. Kunc and A. Siemko (2019). “OSQAR chameleon afterglow search experiment”. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 936: 187.

150. Tardieu, S., D. Mesguich, A. Lonjon, F. Lecouturier, N. Ferreira, G. Chevallier, A. Proietti, C. Estournès and C. Laurent (2019). “Nanostructured 1% silver-copper composite wires with a high tensile strength and a high electrical conductivity”. *Materials Science and Engineering: A*, 761: 138048.

151. Tedeschi, D., M. De Luca, P.E. Faria Junior, A. Granados del Aguila, Q. Gao, H.H. Tan, B. Scharf, P.C.M. Christianen, C. Jagadish, J. Fabian and A. Polimeni (2019). “Unusual spin properties of InP wurtzite nanowires revealed by Zeeman splitting spectroscopy”. *Physical Review B*, 99: 161204(R).

152. Ten Kate, H.H.J., A. Den Ouden and D. Schoerling (2019). “The UT-CERN Cos-theta LHC-Type Nb3Sn Dipole Magnet”. *Nb$_3$Sn Accelerator Magnets - Designs, Technologies and Performance (editors Daniel Schoerling and Alexander V. Zlobin)* Chapter 5.

153. Tereshina, I., T. Kaminskaya, L. Ivanov, G. Politova, H. Drulis, D. Gorbunov, M. Paukov, E. Tereshina-Chitrova and A. Andreev (2019). “Structural, magnetic and magnetocaloric properties of NdPrFe$_{14}$B and its hydrides”. *Journal of Physics: Conference Series*, 1389: 012094.

154. Tereshina, I.S., L.A. Ivanov, E.A. Tereshina-Chitrova, D.I. Gorbunov, M.A. Paukov, L. Havela, H. Drulis, S.A. Granovsky, M. Doerr, V.S. Gaviko and A.V. Andreev (2019). “Tailoring the ferrimagnetic-to-ferromagnetic transition field by interstitial and substitutional atoms in the R–Fe compounds”. *Intermetallics*, 112: 106546.

155. Tokunaga, Y., A. Orlova, N. Bruyant, D. Aoki, H. Mayaffre, S. Krämer, M.-H. Julien, C. Berthier, M. Horvatić, N. Higa, T. Hattori, H. Sakai, S. Kambe and I. Sheikin (2019). “High-field phase diagram of the heavy-fermion metal CeIn$_3$: Pulsed-field NMR study on single crystals up to 56 T”. *Physical Review B*, 99 ({8}): 085142.

156. Urban, J.M., M. Baranowski, A. Kuc, Ł. Kłopotowski, A. Surrente, Y. Ma, D. Włodarczyk, A. Suchocki, D. Ovchinnikov, T. Heine, D.K. Maude, A. Kis and P. Plochocka (2019). “Non equilibrium anisotropic excitons in atomically thin ReS$_2$”. *2D Materials*, 6 (1): 015012.

157. Viirok, J., U. Nagel, T. Rõõm, D.G. Farkas, P. Balla, D. Szaller, V. Kocsis, Y. Tokunaga, Y. Taguchi, Y. Tokura,

B. Bernáth, D. Kamenskyi, I. Kézsmárki, S. Bordács and K. Penc (2019). "Directional dichroism in the paramagnetic state of multiferroics: A case study of infrared light absorption in $Sr_2CoSi_2O_7$ at high temperatures". *Physical Review B*, 99: 014410.

158. Vinograd, I., R. Zhou, H. Mayaffre, S. Krämer, R. Liang, W.N. Hardy, D.A. Bonn and M.-H. Julien (2019). "Nuclear magnetic resonance study of charge density waves under hydrostatic pressure in $YBa_2Cu_3O_y$". *Physical Review B*, 100 ({9}): 094502.
159. Wang, J., Y. He, J. Li, C. Li, H. Kou, P. Zhang and E. Beaugnon (2019). "Nucleation of supercooled Co melts under a high magnetic field". *Materials Chemistry and Physics*, 225: 133-136.
160. Weickert, F., A.A. Aczel, M.B. Stone, V.O. Garlea, C. Dong, Y. Kohama, R. Movshovich, A. Demuer, N. Harrison, M.B. Gamza, A. Steppke, M. Brando, H. Rosner and A.A. Tsirlin (2019). "Field-induced double dome and Bose-Einstein condensation in the crossing quantum spin chain system $AgVOAsO_4$". *Physical Review B*, 100 (10): 104422.
161. Werner, J., S. Sauerland, C. Koo, C. Neef, A. Pollithy, Y. Skourski and R. Klingeler (2019). "High magnetic field phase diagram and failure of the magnetic Grüneisen scaling in $LiFePO_4$". *Physical Review B*, 99 (21): 214432.
162. Wosnitza, J. (2019). "Superconductivity of Organic Charge-Transfer Salts". *Journal of Low Temperature Physics*, 197 (3): 250-271.
163. Wosnitza, J. (2019). "Viewpoint: A Polka-Dot Pattern Emerges in Superfluid Helium". *Physics*, 12 (20).
164. Xu, C.Q., B. Li, M.R. van Delft, W.H. Jiao, W. Zhou, B. Qian, N.D. Zhigadlo, D. Qian, R. Sankar, N.E. Hussey and X. Xu (2019). "Extreme magnetoresistance and pressure-induced superconductivity in the topological semimetal candidate YBi". *Physical Review B*, 99: 024110.
165. Yakushev, M.V., A.V. Mudryi, C. Faugeras and R.W. Martin (2019). "A Magneto-Reflectivity Study of $CuGaSe_2$ Single Crystals". *Physica Status Solidi-Rapid Reserach Letters*, 13 ({2}): 1800374.
166. Yakushev, M.V., A.V. Rodina, R.P. Seisyan, Y.E. Kitaev, S.A. Vaganov, M.A. Abdullaev, A.V. Mudryi, T.V. Kuznetsova, C. Faugeras and R.W. Martin (2019). "Electronic energy band parameters of $CuInSe_2$: Landau levels in magnetotransmission spectra". *Physical Review B*, 100: 235202.
167. Yanagisawa, T., H. Hidaka, H. Amitsuka, S. Zherlitsyn, J. Wosnitza, Y. Yamane and T. Onimaru (2019). "Evidence for the Single-Site Quadrupolar Kondo Effect in the Dilute Non-Kramers System $Y_{1-x}Pr_xIr_2Zn_{20}$". *Physical Review Letters*, 123 (6): 067201.
168. Yin, J., S. Slizovskiy, Y. Cao, S. Hu, Y. Yang, I. Lobanova, B.A. Piot, S.-K. Son, S. Ozdemir, T. Taniguchi, K. Watanabe, K.S. Novoselov, F. Guinea, A.K. Geim, V. Fal'ko and A. Mishchenko (2019). "Dimensional reduction, quantum Hall effect and layer parity in graphite films". *Nature Physics*, 15 (5): 437.
169. Zeisner, J., S.A. Bräuninger, L. Opherden, R. Sarkar, D.I. Gorbunov, J.W. Krizan, T. Herrmannsdörfer, R.J. Cava, J. Wosnitza, B. Büchner, H.H. Klauss and V. Kataev (2019). "Magnetic interactions and spin dynamics in the bond-disordered pyrochlore fluoride $NaCaCo_2F_7$". *Physical Review B*, 99 (15): 155104.
170. Zelewski, S.J., J.M. Urban, A. Surrente, D.K. Maude, A. Kuc, L. Schade, R.D. Johnson, M. Dollmann, P.K. Nayak, H.J. Snaith, P. Radaelli, R. Kudrawiec, R.J. Nicholas, P. Plochocka and M. Baranowski (2019). "Revealing the nature of photoluminescence emission in the metal-halide double perovskite $Cs_2AgBiBr_6$". *J. Mater. Chem. C*, 7: 8350-8356.
171. Zheng, T., B. Zhou, Y. Zhong, J. Wang, S. Shuai, Z. Ren, F. Debray and E. Beaugnon (2019). "Solute trapping in Al-Cu alloys caused by a 29 Tesla super high static magnetic field". *Scientific Reports*, 9: 266.
172. Zhou, W., B. Li, C.Q. Xu, M.D. van Delft, Y.G. Chen, X.C. Fan, B. Qian, N.E. Hussey and X. Xu (2019). "Nonsaturating Magnetoresistance and Nontrivial Band Topology of Type-II Weyl Semimetal $NbIrTe_4$". *Advanced Electronic Materials*, 2019: 1900250.

173. Zhu, Z., P. Nie, B. Fauqué, B. Vignolle, C. Proust, R.D. McDonald, N. Harrison and K. Behnia (2019). “Graphite in 90 T: Evidence for Strong-Coupling Excitonic Pairing”. *Physical Review X*, 9: 011058.
174. Zielińska-Raczyńska, S., D.A. Fishman, C. Faugeras, M.M.P. Potemski, P.H.M. van Loosdrecht, K. Karpiński, G. Czajkowski and D. Ziemkiewicz (2019). “Magneto-excitons in Cu_2O: theoretical model from weak to high magnetic fields”. *New Journal of Physics*, 21 (10): 103012.
175. Zimmerer, C., C.S. Mejia, T. Utech, K. Arnhold, A. Janke and J. Wosnitza (2019). “Inductive Heating Using a High-Magnetic-Field Pulse to Initiate Chemical Reactions to Generate Composite Materials”. *Polymers*, 11 (3): 535.
176. Zinkiewicza, M., K. Nogajewski, M. Bartos, K. Watanabe, T. Taniguchic, M. Potemskia, A. Babinski and M.R. Molas (2019). “Emission Excitation Spectroscopy in WS_2 Monolayer Encapsulated in Hexagonal BN”. *Acta Physica Polenica A*, 136: 624.
177. Zverev, V.N., W. Biberacher, S. Oberbauer, I. Sheikin, P. Alemany, E. Canadell and M.V. Kartsovnik (2019). “Fermi surface properties of the bifunctional organic metal k-$(BETS)_2Mn[N(CN)_2]_3$ near the metal-insulator transition”. *Physical Review B*, 99: 125136.
178. Zvyagin, S.A., D. Graf, T. Sakurai, S. Kimura, H. Nojiri, J. Wosnitza, H. Ohta, T. Ono and H. Tanaka (2019). “Pressure-tuning the quantum spin Hamiltonian of the triangular lattice antiferromagnet Cs_2CuCl_4”. *Nature Communications*, 10 (1): 1064.

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