

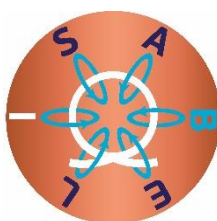


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## ISABEL

### Improving the sustainability of the European Magnetic Field Laboratory

#### D2.2 USER COMMUNITY MEETING REPORT



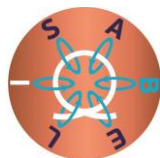
**Start date of the project:** 1<sup>st</sup> November 2020

**Duration:** 48 months

**Project Coordinator:** Geert Rikken – CNRS LNCMI (P1 - CNRS)

**Contact:** [isabel@lncmi.cnrs.fr](mailto:isabel@lncmi.cnrs.fr)

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1.0	First draft	30/06/21	Eva Bezgousko
1.1	Review	23/08/21	Jochen Wosnitza
1.2	Updates on part 1	24/08/21	Eva Bezgousko



1.3	Updates: Part 3 included	31/08/21	Raivo Stern
2.0	Last version reviewed and updated	31/08/21	Coordination Board ISABEL

### DOCUMENT ABSTRACT

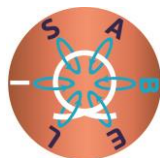
The deliverable is part of the Work Package 2 “Community building and membership enlargement” and Task 2.2 “User Community meetings”. This deliverable is a report of the first Annual User meeting, which took place on the 15<sup>th</sup> of June 2021 in a video format.

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### GLOSSARY

<b>BoD</b>	Board of Directors
<b>EMFL</b>	European Magnetic Field Laboratory
<b>HLD</b>	Hochfeld-Magnetlabor Dresden
<b>LNCMI</b>	Laboratoire National des Champs Magnétiques Intenses
<b>UC</b>	User Committee



## **1. Introduction: Programme, prize winner & presentations**

Organized by HLD, the twelfth user meeting of the European magnetic field laboratories took place on June 15, 2021 in video format. With up to 140 participants of the high-field community logged in to join the virtual venue, it was exceptionally well attended.

The aim of the meeting is to exchange ideas and experiences, to present scientific results, and to discuss about possibilities for improving the facilities' attractiveness. During the meeting, there were introductory talks on the EU-funded projects ISABEL and SuperEMFL, important for the future development of EMFL, as well as invited scientific talks from selected users.

### **USER MEETING PROGRAMME**

#### **09:00 Welcome and introduction**

**Peter Christianen, Director of HFML, Chair of EMFL Board of Directors**

#### **09:10 Announcement of the 2021 EMFL prize winner**

**Jochen Wosnitza, Director of HLD**

#### **Presentation by the EMFL prize winner**

#### **09:40 Presentations by EMFL users (part 1)**

*Chair : Jochen Wosnitza*

1. **Benoît Fauqué (Collège de France, Paris):** *Wide critical fluctuations of the field-induced phase transition in graphite*
2. **Suchitra Sebastian (Cambridge University):** *Magnetic-field-induced metallic YbB<sub>12</sub>*

#### **10:20 – 10:50 Coffee break**

#### **10:50 Presentations by EMFL users (part 2)**

*Chair : Alix McCollam*

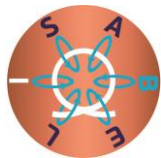
3. **Sven Spachmann (Heidelberg University):** *Magnetostructural coupling in LiFePO<sub>4</sub>*
4. **Alexandre Pourret (CEA-Grenoble):** *Fermi surface changes at the metamagnetic transition in UTe<sub>2</sub>*
5. **Malte Grosche (Cambridge University):** *Fermi surface and mass renormalisation in the iron-based superconductor YFe<sub>2</sub>Ge<sub>2</sub>*

#### **11:50 – 12:50 Lunch break**

#### **12:50 Presentations by EMFL users (part 3)**

*Chair : David Vignolles*

6. **Satya Prakash Bommanaboyena (University of Mainz):** *High-field manipulation of antiferromagnets for spintronics*
7. **Krzysztof Gałkowski (Wrocław University of Science and**



Technology): *Fundamental electronic properties of hybrid perovskites investigated via magneto-spectroscopy*

8. Alban Potherat (Coventry University): *Magnetohydrodynamic turbulence between two and three dimensions*

**13:50 Introduction to EMFL EU projects**

*Chair: Charles Simon*

**13:50 ISABEL**

**Geert Rikken, Coordinator of ISABEL project**

**14:10 SuperEMFL**

**Xavier Chaud, Coordinator of SuperEMFL project**

**14:30 – 14:45 Coffee break**

**14:45 User Committee Meeting (open to all users)**

*Chair : Raivo Stern*

**15:45 Report of User Committee to Board of Directors**

*Chair : Raivo Stern & Carsten Putzke*

**16:00 Wrap up meeting and closure**

## **WELCOME & INTRODUCTION - P. Christianen**

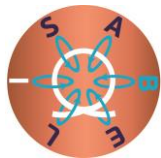
### **a) Current status**

Although the facilities are open, there are still “lock-down” and travel restrictions which limit the access for external users. However, mail-in and staff support procedures are open. Also, regular calls continued, with a special attention to new proposals which require urgency statement.

In 2020, 270 proposals were received and 186 executed. For 2021, 319 proposals were received.

### **b) Infrastructure development**

- In LNCMI Grenoble and HFML Nijmegen facilities, two hybrid magnets are under construction.
- In HZDR Dresden, the infrastructure for pulsed magnetic fields at XFEL are developing.



- In LNCMI Toulouse, a renewal and upgrade of the Megagauss installation are in progress and there are new 14 MJ & 1 MJ capacitor banks in operation.

### c) Horizon 2020 European Projects

- **ISABEL** (Coordinator: Geert Rikken) – Improving the sustainability of the European Magnetic Field Laboratory

The project has started in November for four years (2020-2024), has a consortium of 18 partners, of which 5 are from industry, and has a budget of 4,9 M€.

- ☐ New access modes – user survey launched on the 16<sup>th</sup> of June.
- ☐ Secondment programme – first call out end of June– deadline September 30th, 2021
- ☐ Roadmap next generation user magnets – user survey in preparation

- **SuperEMFL** (Coordinator: Xavier Chaud) – All Superconducting Magnets for the European Magnetic Field Laboratory

The project has started in January 2021 for four years (2021-2025), has a consortium of 11 partners, of which 3 are from industry, and has a budget of 2,9 M€.

- ☐ Design study all superconducting user magnets – user survey in preparation

➔ Further information is available on the EMFL website (User access, H2020 projects...)

### d) A special thanks to Geert Rikken

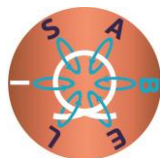
Since 1<sup>st</sup> of January 2021, there have been some changes in the composition of the EMFL Board of Directors (BoD). Geert Rikken has stepped down as director of LNCMI and is succeeded by Charles Simon, who has joined the EMFL BoD and Peter Christianen, director of HFML, fills the BoD chair position. On this occasion, special acknowledgements have been sent to Geert Rikken for his work as a founder of EMFL

### e) 2021 EMFL Prize Winner

Since 2009, the EMFL members award annually the EMFL prize for exceptional achievements in science done in high magnetic fields. This time, Dr. Denis Gorbunov, staff member and local contact at the Dresden High Magnetic Field Laboratory (HLD-EMFL), received the prize for his work in the field of magnetism. In particular he was rewarded for his research on rare-earth transition-metal compounds using a broad suite of experimental techniques, including x-ray experiments at very high, pulsed magnetic fields.

### f) Presentation of EMFL users

The audience enjoyed eight invited talks from selected users reporting on recent scientific highlights done at EMFL facilities (see the list of topics and users' names on the meeting programme page.3).



## 2. Introduction to EMFL EU projects

### a) ISABEL

The project ISABEL aims at providing state-of-the-art high magnetic field facilities that offer the highest possible fields for world-leading research.

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To this end, the ISABEL project aims to strengthen the long-term sustainability of the EMFL through the realization of three objectives:

- strengthening the EMFL structure by enlarging its membership and by improving several organisational aspects, such as data management, outreach and access procedures.
- strengthening the socio-economic impact of the EMFL, by bridging the gap with industry.
- strengthening the role of high magnetic field research in Europe.

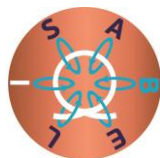
### b) SuperEMFL

The aim of this activity is to support the conceptual and technical design for new research infrastructures which are of a clear European dimension and interest. Major upgrades of existing infrastructures may also be considered if the end result is intended to be equivalent to a new infrastructure.

The concept: The design of a fully superconducting magnet consisting of low-temperature superconducting (LTS) and high-temperature superconducting (HTS) materials that allows to realize new static-field magnets integrated within EMFL.

#### Main tasks:

1. The specification of a set of complementary beyond state-of-the-art all superconducting magnets combining an HTS insert and an LTS outsert as a major upgrade of EMFL facility.
2. The complete (as possible) characterization (electrical, thermal and mechanical) of HTS conductors and test coils.
3. The complete (as possible) design of the above defined superconducting magnets.
4. To demonstrate the feasibility and solve classical technological roadblocks (interactions HTS/ outsert LTS, quench protection, mechanical loads ...) through modelling and tests.
5. To anticipate fabrication of such magnets on an industrial point of view.
6. To prepare a funding roadmap to implement magnets at the EMFL facilities.



## Call for participation

The coordinator of the SuperEMFL project invites the EMFL user committee to join the End-user committee of the project. The aim is to gather the users' feedback about the SuperEMFL targets and assess the different activities of the project according to the needs of the end-users. This committee reports to the Governing Board of the project, at least once per year.

A survey will be prepared and will be available for user committee in next months, in order to collect advisory and discuss about the results in the next User Meeting of June 2022, at LNCMI in Grenoble.

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## **3. User committee meeting**

During the annual meeting of the EMFL User Committee (UC), which is open to all users to attend and give their feedback, recommendations from the user community were discussed and presented to the BoD afterwards. Currently, the UC consists of 9 members. With the user community of EMFL steadily growing, the new UC repeats their request for a renewed, much stronger mandate to represent the interests of the high-field users better. The UC wants to stress that the first priority should be the satisfaction of the users' needs and the aim to carry out world-class research. This priority implies a scientifically active staff, with a significant amount of time dedicated to their own research and developing cutting-edge methods. In addition, the development in new techniques should be driven by collaboration of user support staff with internal and external users.

A key part of the UC's work is to review prior feedbacks and how the EMFL BoD has incorporated it. A point of review this year was the availability of information for users on accessible magnets, cryogenic infrastructure and experimental techniques. While the UC together with the attendees can see progress in this area, particularly on the new EMFL website, a number of users requested a more detailed description with available resolution and documentation.

Another example of continuous and steady progress is aimed at the users themselves. Without their feedback and clear communication of needs for their experiments, the UC cannot help. With the help of the EMFL BoD, a new feedback form was developed. Despite our best efforts it has not led to the expected outcome and the EMFL BoD decided to change to a more immediate questionnaire as one part of the user meetings. The outcome was outstanding. Many of the participants joined in this experiment. The topics chosen were timely and stimulated a fruitful discussion during the UC meeting. However, we still renew here our call for all users to give feedback via the EMFL website. To further improve the amount and quality of feedback forms, the UC has requested a number of changes including:

- a) all EMFL facilities to stimulate their users to provide constructive feedback to the UC;
- b) to implement a feedback-request procedure with reminders within the next 6 months;
- c) to make the comment fields of the feedback form mandatory, since without this insight the plain grades give only rough feedback;
- d) to send the feedback form out automatically after a magnet time so that any issues are fresh in the users' minds.





A revised and improved feedback form should include additional questions centered on scheduling experiments with the local contacts and assignment of magnet time.

Further issues, which were discussed include general data protection rules (GDPR), open data strategy, and online safety trainings. Proposals were made for a part-week test experiments and/or for testing new perspective samples in advance of full proposals. Such programs have been available in the start of new facilities elsewhere and could help to attract new principal investigators. A feedback from the users is very welcome on this matter to discuss the implementation of this system with the BoD.

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The user community is still concerned about a shortage of “workhorse” equipment. To get a better understanding of the most widely used magnets, the user community is encouraged to get in contact and name the magnet they would like to experiment the most. The user committee will then combine this input and discuss strategies with the BoD to meet the need of the community best.

The UC welcomed two new initiatives at the EMFL. First, the new secondment activity allowing scientists and technicians from member states to visit other laboratories and teams. This will greatly strengthen the collaboration between the different members and help to shape a stronger EMFL. Second, the travel support for early-stage scientists from Europe and developing countries for attending the EMFL User Meeting and learning about the EMFL and experimental possibilities there.

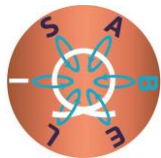
To improve dissemination activities it was suggested, that EMFL would be present with a booth at various European Physical Societies meetings while also organizing topical sessions and giving talks on recent research achievements at EMFL. Presence in various social media platforms (LinkedIn, YouTube, Twitter) might also boost the visibility of the EMFL.

Finally, the UC acknowledged the organizing team from HLD and the BoD for arranging an excellent user workshop where both users and representatives of the EMFL reported on recent developments of high-magnetic-field infrastructures/equipment, 2D materials in high magnetic fields, magnetocaloric materials in pulsed magnets, and research in topical areas and novel material systems of fundamental and technological interest. The user community received this rich program very well.

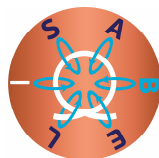
Last but not least the UC would like to thank the EMFL laboratories and its staff for the help during the past years in carrying out experiments on a remote basis. While our colleagues in theory move into the cloud, while Oxford Instruments and other companies start to offer cloud-based access to their instruments we know from experience that best results are achieved in experimental science by scientific expertise and continuity. This new operational scheme has challenged both the users as well as their local contacts on finding new ways to communicate, long extra hours in the laboratory as local contacts had to carry out experiments themselves, and logistics to get samples to the laboratories safely.

We believe the push of EMFL to return to an on-site experience as fast as safely possible ensures the excellence obtained in the laboratory and is further strengthened by the implementation of the project “ISABEL” to make this expertise widely available. It does,





however, require this expertise not only to be developed but also maintained in-house and hence a significant increase in number of permanent staff members is required to ensure a smooth and reliable operation now and in the following years where we learn to live with this “new reality”.

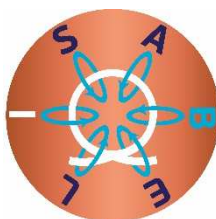


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## ISABEL

### Improving the sustainability of the European Magnetic Field Laboratory

#### D2.2 USER COMMUNITY MEETING REPORT - 2



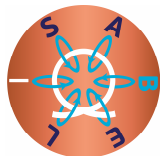
**Start date of the project:** 1<sup>st</sup> November 2020

**Duration:** 48 months

**Project Coordinator:** Geert Rikken – CNRS LNCMI (P1 - CNRS)

**Contact:** [isabel@lncmi.cnrs.fr](mailto:isabel@lncmi.cnrs.fr)

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1.0	First draft	03/08/22	Jochen Wosnitza
1.1	Updates	23/08/22	Eva Bezgousko
2.0	Final version	06/02/23	Eva Bezgousko

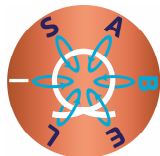


## Document abstract

The deliverable is part of the Work Package 2 “Community building and membership enlargement” and Task 2.2 “User Community meetings”. This deliverable is a report of the second Annual User meeting, which took place on the 15<sup>th</sup> of June 2022 at the LNCMI in Grenoble in hybrid format.

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## 1. Introduction & User-meeting program

The aim of the yearly user meetings is to exchange ideas and experiences, to present scientific results obtained in the EMFL facilities, and to discuss about possibilities for improving further the performance of the facilities. During the meeting, newest developments of the EMFL facilities as well as invited scientific talks from selected users were presented. In addition, the yearly User Committee meeting took place.

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After the online user meeting 2021, the organizers of the 2022 user meeting were happy to see quite a number of users and staff in reality during the meeting. The EMFL user meeting took place in Grenoble at the LNCMI on June 15 in hybrid format. With up to 90 participants, 35 on site and 55 remotely connected, the meeting was very well attended. The in-person discussions during coffee and lunch breaks were particularly productive in exchanging ideas and experiences between users and EMFL staff.

### USER MEETING PROGRAM

#### **08:45 Arrival and registration – LNCMI-Grenoble**

#### **09:15 Welcome and introduction**

Peter Christianen, Director of HFML, Chair of EMFL Board of Directors

#### **09:35 Announcement of the 2022 EMFL prize winner**

Jochen Wosnitza, Director of HLD

#### **09:40 Presentation by the EMFL prize winner**

#### **10:10 Presentations by EMFL users – Session 1**

1. Stanislaw Galeski (Max Planck Institute CPfS, Dresden) – remote

Signatures of a magnetic-field-induced Lifshitz transition in the ultra-quantum limit of the topological semimetal  $\text{ZrTe}_5$

2. Charis Quay (LPS Orsay) – remote

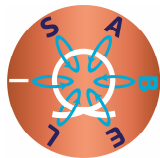
Tunneling spectroscopy of few-monolayer  $\text{NbSe}_2$  in high magnetic fields

#### **10:50 – 11:20 Coffee break**

#### **10:50 Presentations by EMFL users – Session 2**

3. Shravani Chillal (Helmholtz-Zentrum Berlin and TU Berlin) – remote

Magnetic phase diagrams of new three-dimensional quantum magnets



4. Marco Bonura (University of Geneva)  
Record high upper critical field in the  $\text{MgB}_2$  superconductor

**12:00 – 13:30 Lunch break**

**12:50 Presentations by EMFL users – Session 3**

5. Elena Blundo (Sapienza University Rome)  
Gyromagnetic factor of k-space direct and indirect excitons in strained  $\text{WS}_2$  monolayers

6. Maciej Molas (Warsaw University)  
Magneto-spectroscopy of excitons in monolayers of transition metal dichalcogenides alloys

7. Julien Fuchs (LULI)  
Recent advances in laboratory astrophysics using laser-driven magnetised plasmas

8. Michael Schmitz (Aachen University) – remote  
CVD graphene in high magnetic fields

**14:50 – 15:20 Coffee break**

**15:20 User Committee Meeting (open to all users)**

*Chair: Raivo Stern*

**16:20 Report of User Committee to Board of Directors**

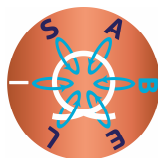
*Chair : Raivo Stern*

**16:35 Wrap up meeting and closure**

## 2. Welcome presentation (Chair EMFL BoD, Peter Christianen)

The meeting started with a warm welcome by Peter Christianen, chairperson of the EMFL Board of Directors and director of the HFML. In his talk, he discussed the situation caused by the Covid 19 pandemic and the Ukraine war, which both influence severely the user operations of the EMFL facilities. Further, he presented recent technical developments of the EMFL infrastructures, summarized the scientific activities, and reported on some selected scientific highlights.

Below, some details of Peter's presentation:



## a) Operation facilities & output

After seizing most of the sanitary restrictions, the facilities have resumed “regular” operation. However, the situation is not completely recovered due to a remaining backlog of projects and the large number of proposals executed via mail-in (76 in 2021) that required strong staff support. The regular calls continued, and in 2021, 194 user projects have been performed.

In 2021, 189 peer-reviewed papers were published and 9 PhD theses were defended.

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## b) Infrastructure developments

- At the LNCMI Grenoble facility, the 43 Tesla hybrid system is under development and magnet cool-down is expected for June 2022. At LNCMI-Toulouse, a pulsed magnetic dipole for magnetic birefringence measurements has been designed.
- At the Nijmegen facility (HMFL FELIX): the 45 Tesla hybrid system project is ongoing with final tests of the cryostat planned for summer 2022, as well as magnet cool-down for end of 2022.
- At the HLD facility: New pulsed magnet prototype tested for HIBEF up to 52 T.

## c) ISABEL project (Improving the Sustainability of the European Magnetic Field Laboratory)

**2020-2024, 18 partners, budget 4,9 M€, started 1 November 2020**

Seven regional facilities partner the project and it is planned to organize workshops and trainings. Under ISABEL, the development of new access modes has started (<https://emfl.eu/apply-for-magnet-time/>). A User Survey in 2021 helped to define the user needs in terms of facility access:

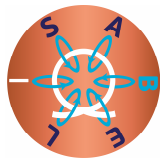
- **Dual access** (since call in April 2021): 10 project proposals so far
- **First-time access** (since call in April 2022): 9 project proposals so far

Other novel access modes (Long-term, Industrial, fast-track, technical development) are in preparation.

ISABEL supports EMFL secondments. In 2021, the call received 12 proposals (37.1 k€), 10 proposals were granted (22.4 k€). A new call will soon be launched.

ISABEL pursues its objective to bridge the gap between EMFL and industry. To carry this action, a new Industrial Liaison officer has joined the project at LNCMI Toulouse - Aimée Savourey. The industry-related developments of ISABEL done recently are:

- IPR and technology transfer trainings in 2021 for EMFL staff
- Opening of innovation call in December 2021
- EMFL skill map completed and downloaded on the EMFL website.
- Participations to exhibition visits (5 planned for 2022).
- Industrial Partner Club to be launched in November 2022.



The project has also begun to develop measures in order to increase the collaboration with other research infrastructures; workshops are under preparation. The first one will be performed at ILL, dedicated to neutrons, in November 2022. Workshops on lasers, FELs, Xrays will be organized in the near future.

The ISABEL team carries out a study on magnet technology and plans to create a user survey. The team further thinks about new design tools based on sustainable principles (energy, efficiency, recycling).

On the international level, strategical external connections are tightening (HiFF, CERN, FuSuMaTech, and the European MRI community).

In order to keep the community informed and to reach out to a wider audience, ISABEL has developed various communication tools – website updates, social media developments, flyers, etc.

#### d) SuperEMFL (All superconducting magnets for the European Magnetic Field Laboratory)

**2021-2025, 11 partners, budget 2,9M€, started January 2021**

Goal is the design of a fully superconducting magnet consisting of low-temperature superconducting (LTS) and high-temperature superconducting (HTS) materials that allows to realize new static-field magnets integrated within EMFL.

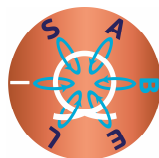
So far, the SuperEMFL project has accomplished the following tasks in reaching its objective:

- March 2022: Critical current measurements of Theva's tape at LNCMI-Grenoble
- June 2022: Complementary critical current measurements at HFML Nijmegen
- End of 2022: Test measurements of 2 double pancake coil configurations at LNCMI-Grenoble
- A set of insert designs computed by WP4 partners according to the existing tape data
- LTS magnet being prepared at HLD Dresden to accommodate HTS inserts, such as the 2 double pancake coils provided by LNCMI
- In April 2022, new tests of the NOUGAT insert showed that levitation of helium bubbles reduces the cooling efficiency. So far, the achievable field under good cooling conditions is limited to about 28 T
- Next SuperEMFL general meeting June 16<sup>th</sup> in Grenoble
- User questionnaire ready to be launched (June 2022)

#### e) Leaving of EMFL's Executive Manager

A special thanks was dedicated to Martin van Breukelen, EMFL executive manager since 2013. Martin van Breukelen left his function in June 2022.





## f) Announcement of EMFL Prize Winner 2022

Jochen Wosnitza, chair of the Selection Committee, announced this year's EMFL prizewinner, Mateusz Dyksik, who, afterwards, presented highlights of his high-field research in a talk on "Excitonic properties of 2D layered perovskites revealed by magneto-spectroscopy".

## 3. Users' presentations

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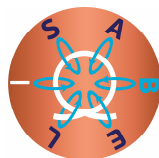
The audience was then able to appreciate the excellent talks of the eight invited speakers who presented their work done as users at the EMFL facilities. Stanislaw Galeski (Max Planck Institute CPfS, Dresden) covered his high-field research on the topological semimetal  $\text{ZrTe}_5$ . Charis Quay (LPS Orsay) presented results on tunneling spectroscopy of few-monolayer  $\text{NbSe}_2$  in high magnetic fields and Shravani Chillal (Helmholtz-Zentrum Berlin and TU Berlin) on magnetic phase diagrams of quantum magnets. Marco Bonura (University of Geneva) presented more applied results on record high upper critical field in the superconductor  $\text{MgB}_2$ . After lunch (for in-person participants), Elena Blundo (Sapienza University Rome) gave a talk on k-space direct and indirect excitons in strained  $\text{WS}_2$  monolayers and Maciej Molas (Warsaw University) on excitons in monolayers of transition-metal dichalcogenides. Touching a more exotic topic, Julien Fuchs (LULI) reported on recent advances in laboratory astrophysics using laser-driven magnetized plasmas. Finally, Michael Schmitz (Aachen University) presented results on graphene in high magnetic fields.

## 4. User-Community meeting

After the cancellation of the user meeting in 2020 due to the worldwide pandemic related shutdown, and the "new reality" online user meeting in 2021, the EMFL and its user community gathered in hybrid format for its annual user meeting for 2022 in Grenoble. The high participation of up to 90 participants (35 on site, 55 remotely) showed the genuine desire for a meeting to exchange on current developments and scientific progress. With the high attendance, the user community reacts very positively to the adjustment in the meeting format and encourages the EMFL Board of Directors (BoD) to consider a hybrid format for future meetings.

The EMFL User Committee (UC) joins the community in congratulating Dr. Mateusz Dyksik for the 2022 EMFL prize. His works demonstrate the high-quality research carried out within the EMFL facilities in cooperation with the project partners of "ISABEL" and their dedication to driving new scientific development.

During the annual meeting of the UC, which is open to all users to attend and provide feedback, recommendations from the user community were discussed and presented to the BoD. Currently, the UC consists of 10 members. With the user community of EMFL steadily growing, the UC repeats their request for a renewed, much stronger mandate to better represent the interests of the high-field users. The UC wants to stress that the first priority should be the satisfaction of users' needs and the goal of performing world-class research. This priority implies a scientifically active staff with a significant amount of time dedicated to their in-house research and developing cutting-edge methods. We are happy that this priority is well



recognized and adopted by the BoD. In addition, the development of new techniques should be driven by the collaboration of user support staff with users.

A key part of the UC's work is to review prior feedbacks and how the EMFL BoD has incorporated it. A point of review this year was the availability of information for users on accessible magnets, cryogenic infrastructure, and experimental techniques. The UC together with the attendees concluded a very slow if any progress in this area, particularly on the new EMFL website. Those users who requested a more detailed description with available resolution and documentation are asked to specify their needs with local contacts in the labs. The UC encourages the users to also address these comments and requests via email to one of the UC-members such that progress in this regard can be monitored and reviewed.

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Another example of continuous and steady progress is aimed at the users themselves. Without their feedback and clear communication of the needs for their experiments, the UC cannot help. We still emphasize our call here for all users to give substantive feedback via the EMFL website.

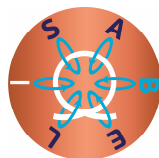
Further issues which were discussed include general data protection rules (GDPR), open data strategy, and online safety trainings. Many of these activities are currently being run under the project "ISABEL". Proposals were made for part-week test experiments and/or for testing new perspective samples in advance of full proposals. Such programs are available at other facilities in the field of synchrotron and elsewhere and help to attract new principal investigators. Feedback from the users is very welcome on this matter to discuss the implementation of such a system with the BoD.

The user community is still concerned about the shortage of "workhorse" equipment. To get a better understanding of the most widely used magnets, we ask the user community to get in contact with the UC and name the magnet they would find most suitable for their experiments, and participate actively in the respective survey from "ISABEL". The UC will then combine this input and discuss strategies with the BoD on how to meet the needs of the community.

The UC welcomed two initiatives at the EMFL. First, the secondment activity allows scientists and technicians from member states to visit other laboratories and teams. This is greatly strengthening the collaboration between the different members and helps shape a stronger EMFL. Second, travel support for early-stage scientists from Europe and developing countries for attending the EMFL User Meeting and learning about the EMFL and experimental possibilities there.

To improve dissemination activities, it was suggested that EMFL would be present with a booth at various European Physical Societies meetings whilst also organizing topical sessions and giving talks on recent research achievements. Postings on additional social media platforms (ResearchGate, Instagram, YouTube) might also boost the visibility of the EMFL; presence on Twitter and LinkedIn is already quite active.

Finally, the UC acknowledged the organizing team from LNCMI-G and the BoD for arranging an excellent user workshop where both users and representatives of the EMFL reported on recent developments of high-magnetic-field infrastructures/equipment, 2D materials in high magnetic fields, magnetocaloric materials in pulsed magnets, and research in topical areas as



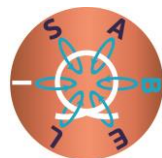
well as novel material systems of fundamental and technological interest. This rich program was well received by the user community.

Last but not least, the UC on behalf of all users would like to thank the EMFL laboratories and their staff for the help during the past years in carrying out experiments on a remote basis. This new operational scheme has challenged both the users as well as their local contacts on finding new ways to communicate, long extra hours in the laboratory, as local contacts had to carry out experiments themselves and logistics to get samples to the laboratories safely.

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We believe that the desire of EMFL to return to a full on-site experience for the users as fast and as safely as possible confirms the excellence obtained in the laboratory and is further strengthened by the implementation of the project "ISABEL" to ensure that this expertise is widely available. It does, however, necessitate this expertise not only to be developed but also maintained in-house and hence a significant increase in the number of permanent staff members is required to safeguard a smooth and reliable operation now and in the following years.

After not being able to meet in person for 2 years, the hybrid meeting in Grenoble was a big success. It was a great pleasure to renew and deepen contacts in person and to include the participants in remote mode. We hope to be able to maintain this format as well in the future. The next user meeting will take place in Nijmegen, again in June.

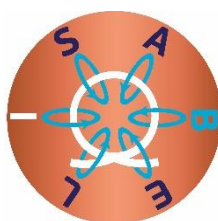


<b>Deliverable Number:</b> D2.2	<b>Due date:</b> June 2023
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<b>Dissemination level:</b> Public	

## ISABEL

### Improving the sustainability of the European Magnetic Field Laboratory

#### D2.2 USER COMMUNITY MEETING MINUTES REPORT - 3



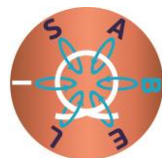
**Start date of the project:** 1<sup>st</sup> November 2020

**Duration:** 48 months

**Project Coordinator:** Geert Rikken – CNRS LNCMI (P1 - CNRS)

**Contact:** [isabel@lncmi.cnrs.fr](mailto:isabel@lncmi.cnrs.fr)

Version	Modifications	Date	Authors
1.0	First draft – User Meeting	09/11/23	Uli Zeitler
1.1	First draft – User Committee	14/11/2023	Raivo Stern
1.2	Updates	22/11/2023	Jochen Wosnitza
2.0	Final version	12/12/2023	Eva Bezgousko



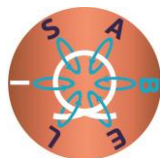
## Document abstract

The deliverable is part of Work Package 2 “Community building and membership enlargement” and Task 2.2 “User Community meetings”. This deliverable is a report of the third Annual User meeting, which took place on the 12th and 13th June 2023 in Nijmegen.

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## 1. Introduction & User-meeting program

The aim of the yearly EMFL User Meeting is to exchange ideas and experiences, to present scientific results obtained in the EMFL facilities, and to discuss possibilities for a further improvement of the facilities' infrastructure and performance. During the meeting, newest developments of the EMFL facilities as well as invited scientific talks from selected users were presented. In addition, the yearly User Committee meeting and a dedicated workshop "*The Combination of High Magnetic Fields and Free Electron Lasers*" took place.

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After the online and hybrid meetings imposed by COVID-19 in 2021 and 2022, the User Meeting 2023 was again organized in its traditional on-site form (with the possibility to also follow it online). It took place at HFML-FELIX in Nijmegen on Tuesday, June 13 (afternoon) and Wednesday, June 14 (morning) and was organized in parallel with an HFML-FELIX user meeting and an ISABEL-supported workshop on the combination of high magnetic fields and THz radiation. In total 93 participants registered for the meeting. On top of the scientific talks of high quality, the in-person discussions during coffee and lunch breaks and a BBQ dinner on Tuesday evening were particularly productive in exchanging ideas and experiences between users and EMFL staff.

### EMFL USER MEETING 2023 - PROGRAM

#### **Tuesday, 13 June 2023**

12:00 Arrival and lunch – HFML-FELIX, Radboud University, Nijmegen

13:30 Welcome and introduction – EMFL /HFML-FELIX user meeting

Britta Redlich, Director HFML-FELIX, Nijmegen

13:35 **Plenary talk EMFL / HFML-FELIX user meetings**

*Gas-phase ion fluorescence spectroscopy – Seeing the light*

Steen Brøndsted Nielsen, Aarhus University

14:30 Welcome and Introduction – EMFL user meeting

Charles Simon, Chair EMFL BoD and Director LNCMI-CNRS, Grenoble/Toulouse

14:50 Announcement of the 2022 EMFL prize winner

Jochen Wosnitza, Chair EMFL Selection Committee & Director HLD-HZDR, Dresden

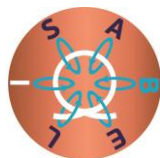
14:55 Presentation by the EMFL prize winner

*The Dual Character of Cuprate Superconductors*

Jake Ayres, University of Bristol

#### **Invited talks by EMFL users**

15:20 Research in megagauss fields: the quest for non-perturbative magnetic field effects



- Yasuhiro Matsuda, University of Tokyo
- 15:40 Magneto-optics of Weyl semimetals  
Ana Akrap, University of Fribourg
- 16:00 Electrons with Planckian Scattering in Strange Metals  
Amirreza Ataei, University of Sherbrooke – online talk
- 16:20 Coffee break
- 16:40 **User Committee Meeting**  
Raivo Stern, NICPB Talin, Chair of the EMFL User Committee
- 17:40 Report of the User Committee to the EMFL Board of Directors
- 18:00 Barbeque in the “HFML-FELIX garden”  
& Time for informal lab visits and discussions

**Wednesday, 13 June 2023**

- 09:00 Magnetic quantum oscillations and purity-boosted triplet superconductivity in  $\text{UTe}_2$   
Alex Eaton, University of Cambridge
- 09:20 Quantum Hall effect in hybrid heterostructures based on graphene  
Amalia Patane, University of Nottingham
- 09:40 Superconductors under very high pressure  
Sven Friedemann, University of Bristol
- 10:00 Single photon emission from sulphur vacancies in monolayer  $\text{MoS}_2$ :  
insight from high-field spectroscopy  
Andreas Stier, TU Munich
- 10:20 Superconducting 2D materials  
Justin Ye, University of Groningen
- 10:40 **Discussion and feedback on future magnet design (ISABEL Work Package 9)**  
Oliver Portugall, LNCMI-CNRS, Toulouse
- 11:00 Coffee break
- 11:30 **Plenary talk EMFL / HFML-FELIX user meetings**  
Far-infrared, non-linear Ramsey spectroscopy applied to donors in silicon at high  
magnetic field  
Ben Mordin, University of Surrey
- 12:30 Lunch
- 14:00 HFML-FELIX / ISABEL Workshop**  
*The Combination of High Magnetic Fields and Free Electron Lasers*





## 2. Welcome presentations

The joint EMFL / HFML-FELIX user meeting started with a warm welcome by Britta Redlich, director of HFML-FELIX and a plenary talk entitled “*Gas-phase ion fluorescence spectroscopy – Seeing the light*” given by Steen Brøndsted Nielsen from Aarhus University.

The EMFL part of the meeting was then opened by Charles Simon, chairperson of the EMFL Board of Directors and director of LNCMI who presented recent technological developments and scientific highlights from EMFL. In addition, he provided an overview of the projects performed at EMFL, some recent development related specifically to ISABEL, and discussed EMFL's global strategic goals and initiatives.

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Below, some details of Charles Simon's presentation:

### a) Operation facilities & output

The number of projects requested and executed at the EMFL is increasing again and has started to return to a pre-covid situation. However, since there are often typically 1-2 years between the execution of a project and the publication of the results, the output in 2022 measured as number of publications is still significantly below the pre-pandemic level but we are confident that this will soon increase again.

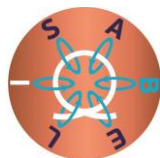
In 2022, 189 proposal were executed, 150 peer-reviewed papers were published and 7 PhD theses were defended.

### b) Networking activities

The period since the last user meeting in Grenoble was also the year to resume EMFL network activities. It started in June 2022 with the annual EMFL user meeting held at LNCMI in Grenoble, France, where a part of the EMFL users were again able to meet on-site and the larger rest joined online. In September 2022, the large majority of the staff of all four EMFL facilities came together in Kerkrade, the Netherlands and an EMFL school was held at the same location directly afterwards. In Mai 2023, a Regional Meeting of the community of Polish researchers involved in high-magnetic-field research was held at the University of Science and Technology in Wroclaw, Poland.

### c) Technical developments

- HLD developed and commissioned several new user magnets:
  - A 100 T / 10 ms / 12 mm bore triple-coil magnet  
The inner and middle coil were already wound in June 2023, the outer coil was in production)
  - New user-demand magnets:
    - 55 T / 150 ms / 20 mm (magnetocaloric effect)
    - 60 T / 25 ms / 16 mm (magnetization)
    - 70 T / 150 ms / 20 mm (with cooling channels)



- The installation and commissioning of the 43 T hybrid magnet at LNCMI Grenoble is progressing further, the commissioning is expected for the end of 2023. Additionally, in 2024, LNCMI Grenoble will upgrade its maximum power from 24 MW to 30 MW, which will enable the lab to reach higher fields and to also further optimize the overall power consumption.
- At HFML in Nijmegen, the 45 Tesla hybrid system project is ongoing with final tests of the cryostat planned towards the end of 2023 and commissioning of the system in the course of 2024.

#### d) EMFL strategic goals

EMFL strives for scientific excellence for the in-house and user research programs in a maximum number of research areas and aims to improve the high-field infrastructure and instrumentation, including superconducting magnet technology and the combination with other large-scale Research Infrastructures.

In order to reach these objectives, EMFL has developed several measures designed to enhance the scientific and socio-economic impact of EMFL as a whole. For example, supported by their stakeholders, EMFL is working on an expansion of its membership and on an improvement of the communication and outreach activities. With this it aims to enhance the awareness among scientists and the general public on the excellent science, technology, and education done at EMFL. Additionally, at the moment seven regional facilities have joined EMFL to further promote EMFL activities, provide information to (prospective) users and to organize regional workshops and training. The dual-access mode, where users can start high-field project at a regional facility and then move further to one of the large-scale EMFL facilities, is now well developed.

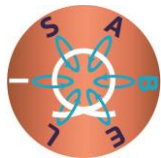
#### e) ISABEL developments

Within ISABEL, the development of new access modes has started (<https://emfl.eu/apply-for-magnet-time/>). A User Survey in 2021 helped to define the user needs in terms of facility access:

- **Dual access** (since call in April 2021): 5 project proposals submitted in 2022
- **First-time** access (since call in April 2022): 28 project proposals submitted in 2022
- **Long-term** access (since call in April 2023): 2 proposals submitted in 2022
- **Fast-track** access (since call in October 2022): 3 proposals submitted in 2022
- **Technical** access (since call in October 2022): 1 proposal submitted in 2022
- **Industrial** access mode (in preparation).

ISABEL secondments have resumed at full steam in 2022/23 and a new call will be launched in September 2023.

ISABEL is also working on a magnet-technology roadmap. For this purpose, a user survey was conducted and magnet-technology-related issues were discussed with users during the user meeting.



On the international level, strategical external connections are tightening (HiFF, CERN, FuSuMaTech, and the European MRI community).

In order to keep the community informed and to reach out to a wider audience, ISABEL has also developed various communication tools – website updates, social-media developments, flyers, etc.

#### f) Participation of EMFL in other initiatives

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- EMFL chaired the coordination board of ARIE (Analytical Research Infrastructures in Europe), which represents the main analytical infrastructures of scientific and technological excellence in Europe.

Within ARIE, there exist currently 3 EU proposals with ARIE contribution:

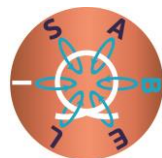
- o ReMade@ARI [HZDR] (Circular Economy), 14 Mio €, 4 years, 46 beneficiaries
- o CANServ [INSPIRE] (Precision Medicine), 15 Mio €; only small part to INSPIRE
- o eRI mote [DESY] (remote/digital access), 1.5 Mio €, 30 months, 8 beneficiaries

In order to enhance visibility, ARIE is also lobbying for Research Infrastructures at the EU level.

- Together with the European Spallation Source (ESS) (coordinator), the Extreme Light Infrastructure (ELI) and two industrial partners (Energy Pool and Alfa Laval) EMFL has successfully submitted a 5-M€ INRFATECH proposal named FlexRICAN (Flexibility in Research Infrastructures: Towards Carbon Neutral). In the next five years this project will help to increase the long-term sustainability of European Research Infrastructures and to meaningfully contribute to the resilience of the European electric-energy distribution system.

#### g) Announcement of EMFL Prize Winner 2023

Jochen Wosnitza, chair of the EMFL prize committee, announced this year's EMFL prize-winner, Jake Ayres from the University of Bristol, UK. After the prize-awarding ceremony, Jake presented highlights of his high-field research, performed in both continuous as well as pulsed magnetic fields, in a talk entitled "The Dual Character of Cuprate Superconductors".



### 3. Users' presentations

On Tuesday afternoon, the audience was then able to appreciate the excellent talks of the first group of invited speakers who presented their work done as users at one or more of the four EMFL facilities.

Yasuhiro Matsuda, University of Tokyo started off with presenting experiments performed in megagauss fields (pulsed magnetic fields above 100 T) and the quest for non-perturbative magnetic-field effects. This talk was also intended as a start to a future collaboration between EMFL and the High Magnetic Field Collaboratory in Japan.

In the second talk, Ana Akrap from the University of Fribourg gave an overview on magneto-optics in Weyl semimetals and Amirreza Ataei from the University of Sherbrooke concluded the session with an online talk entitled "Electrons with Planckian Scattering in Strange Metals".

After a coffee break, Raivo Stern chaired the EMFL User Committee Meeting (see section 5 of this report) and the results of the discussions were subsequently reported to the EMFL Board of Directors.

On the following morning, the program continued with five additional invited talks given by Alex Eaton from the University of Cambridge (Magnetic quantum oscillations and purity-boosted triplet superconductivity in  $\text{UTe}_2$ ), Amalia Patane from the University of Nottingham (Quantum Hall effect in hybrid heterostructures based on graphene), Sven Friedemann from the University of Bristol (Superconductors under very high pressure), Andreas Stier from the Technical University of Munich (Single photon emission from sulphur vacancies in monolayer  $\text{MoS}_2$ ), and Justin Ye from the University of Groningen (Superconducting 2D materials).

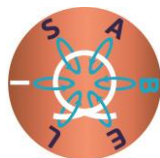
The final session of the EMFL user meeting chaired by Oliver Portugall (LNCMI) Toulouse was then devoted to a discussion with EMFL users and staff on future magnet designs.

### 4. Conclusion of the meeting and HFML-FELIX workshop

The joint EMFL / HFML-FELIX user meeting concluded with a plenary talk entitled "*Far-infrared, non-linear Ramsey spectroscopy applied to donors in silicon at high magnetic field*" given by Ben Mordin from the University of Surrey and on Wednesday afternoon and Thursday morning a HFML-FELIX / ISABEL workshop dedicated to the combination of High Magnetic Fields and Free Electron Lasers providing THz radiation was held.

### 5. User-Community meeting

After the previous successful hybrid user meeting in 2022 in Grenoble, the EMFL and its user community gathered again in hybrid format, but mostly with onsite users for its annual user meeting for 2023 in Nijmegen. The user community reacts very positively to this meeting format and encourages the EMFL Board of Directors (BoD) to consider a hybrid format also for future meetings.



The EMFL User Committee (UC) joins the community in congratulating Dr. Jake Ayres (University of Bristol) for the 2023 EMFL prize. His works demonstrate the high-quality research carried out within the EMFL facilities and their dedication to driving new scientific development.

During the annual meeting of the UC, which is open to all users to attend and provide feedback, recommendations from the user community were discussed and presented to the BoD. With the user community of EMFL steadily growing, the UC again repeats their request for a renewed, stronger mandate to better represent the interests of the high-field users. The UC emphasizes that the first priority is the satisfaction of user needs and the goal of performing world-class research. This priority implies a scientifically active staff with a significant amount of time dedicated to their in-house research and developing cutting-edge methods, driven by staff scientists own interests and collaborations with users. We are happy that this priority is well recognized and adopted by the BoD.

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A key part of the UC's work is to review prior feedbacks and how the EMFL BoD has incorporated them. The UC together with the attendees concluded a very slow if any progress in this area. Those users who requested detailed descriptions of available set-ups with resolution and documentation are asked to specify their needs with local contacts in the labs. Another continuous and steady progress is aimed at the users themselves. Without their clear communication of the needs for their experiments, the UC cannot help. UC stresses once again for all users should give sustentive feedback via the EMFL website.

Other issues discussed include general data protection rules (GDPR), open data strategy, and online safety trainings. Most of these activities are currently being run under the ISABEL project. Proposals were made for standardization of CAD software (which was set aside as all packages can generate STEP files that are seamlessly importable), part-week test experiments and/or for testing new perspective samples in advance of full proposals, and a dramatic increase in staff scientists that have a majority of their time for individual research.

The user community is still concerned about the shortage of "workhorse" equipment. To get a good understanding of the most widely used magnets, we ask the user community to participate actively in the respective survey from ISABEL at <https://emfl.eu/isabel/magnet-survey/>. The UC will then discuss strategies with the BoD on how to meet the needs of the community.

Finally, the UC acknowledged the organizing team from HMFL-FELIX and the BoD for arranging an excellent user workshop (supported by the ISABEL project) on the combination of high fields and THz radiation. In particular, the possibilities of the existing combination HFML-FELIX in Nijmegen and HLD-FELBE in Dresden were introduced. This rich program was well received by the user community.

Last but not least, the UC on behalf of all users would like to thank the EMFL laboratories and their staff for the help during the past years in carrying out our experiments and the return to full on-site mode as fast and as safely as possible, further strengthened by the implementation of the ISABEL project.