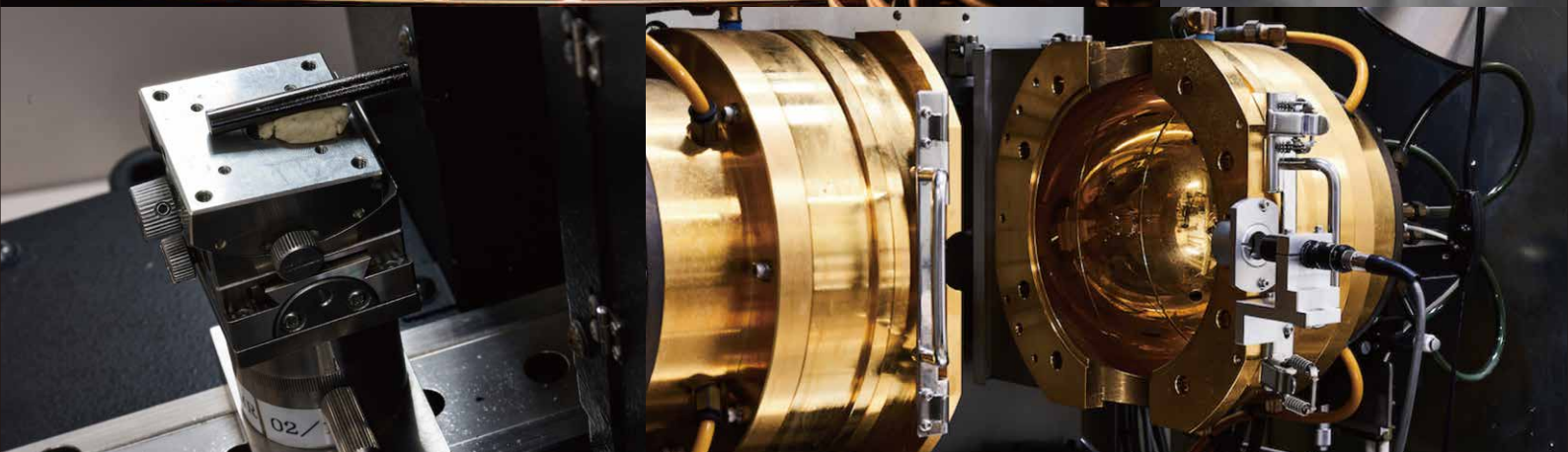
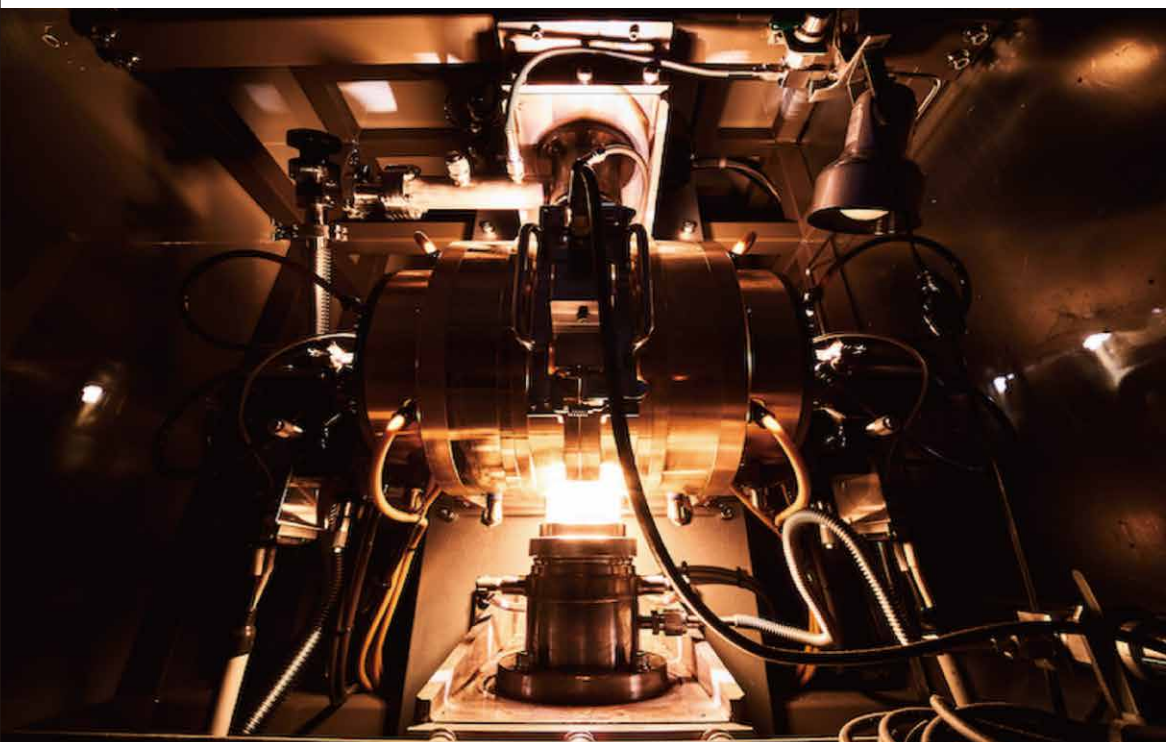


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ICC-IMR Activities in FY 2022

Visiting Professors



Arnaud Joel Badel
CNRS, France
March 1, 2022-February 28, 2023

"High Temperature Superconductors for Very High Field Magnets Beyond 30 T" (Host: S. Awaji, IMR)



Rasmus Toft-Petersen
Technical University of Denmark
April 1, 2022-December 1, 2022

"High-Field Magnetic Phase Transitions in Magnetolectric Systems" (Host: H. Nojiri, IMR)



Sanjit Konar
Indian Institute of Science Education and Research (IISER) Bhopal, India
May 9, 2022-June 8, 2022

"Design of Redox-Active Porous Molecular Materials for Guest Induced Controlling of Electron Conduction and Magnetic Properties" (Host: H. Miyasaka, IMR)



Farhad Rézai-Aria
Institut Mines-Télécom, École Nationale Supérieure des Mines d'Albi-Carmaux, Institut Clément Ader Site -Albi, France
June 6, 2022-August 5, 2022

"TA2M5: Thermomechanical Assessments of Additively Manufactured Metallic Materials & Multi-Materials" (Host: A. Chiba, IMR)



Hidekazu Kurebayashi
University College London, UK
July 1, 2022-August 31, 2022

"Fabricating Marmin Wagner Magnets by State-of-The-Art Thin-Film Growth Techniques" (Host: T. Seki, IMR)



Matthias Miltzer
The University of British Columbia, Canada
July 11, 2022-September 9, 2022

"Modelling of Alloying Element Interaction with Migrating Interfaces in Metals and Alloys" (Host: T. Furuhashi, IMR)



Junichiro Kono
Rice University, USA
October 1, 2022-September 30, 2023

"Spectroscopy of Matter in High Magnetic Fields" (Host: H. Nojiri, IMR)



Thierry Duffar
Grenoble Institute of Technology, France
October 1, 2022-November 30, 2022

"Growth Kinetics at Crystal/ Melt Interface" (Host: K. Fujiwara, IMR)



Wojciech Gieszczyk
Institute of Nuclear Physics Polish Academy of Sciences, Poland
January 16, 2023-April 14, 2023

"Dosimetry of Ionizing Radiation Using Stimulated Luminescence Phenomena" (Host: A. Yoshikawa, IMR)

International Workshop

GIMRT Workshop: Recent Topics in Low Temperature Physics, Sendai, 2022.8.17

Organizer: D. Aoki, IMR

ICC-IMR Sponsor session: 29th International Conference on Low Temperature Physics, Sapporo, 2022.8.18-8.24

Organizer: A. Tsukazaki, IMR

GIMRT Workshop: 17th International Workshop on Biomaterials in Interface Science, Sendai, 2022.8.24

Organizer: H. Kato, IMR

GIMRT Workshop: IMR International Symposium on Frontier and Perspectives of Molecule-Based Magnets, Sendai, 2022.10.8

Organizer: H. Miyasaka, IMR

GIMRT Workshop: The 6th Symposium for the Core Research Clusters for Materials Science and Spintronics, and the 5th Symposium on International Joint Graduate Programs in Materials Science, Sendai Online, 2022.10.24-10.27

Organizer: T. Sasaki, IMR

GIMRT Workshop: International Symposium on Functional Materials 2022 Autumn Seminar, Sendai, 2022.10.29-10.30

Organizer: A. Yoshikawa, IMR

GIMRT Workshop: Asia-Pacific Conference on Condensed Matter Physics 2022, Sendai, 2022.11.21-11.23

Organizer: H. Nojiri, IMR

GIMRT Workshop: GIMRT, REIMEI and IRN joint international workshop: Superconductivity, Structural Complexity and Topology of UTe₂ and Aperiodic Crystals, Sendai, 2022.11.30-12.2

Organizer: D. Aoki, IMR

GIMRT Workshop: 7th French-Japanese High Field Research Collaboration Workshop, Zao, 2023.3.8-3.10

Organizer: S. Awaji, IMR

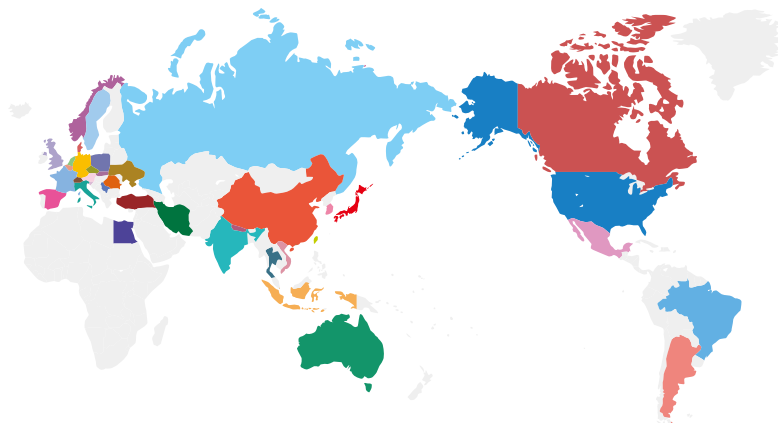
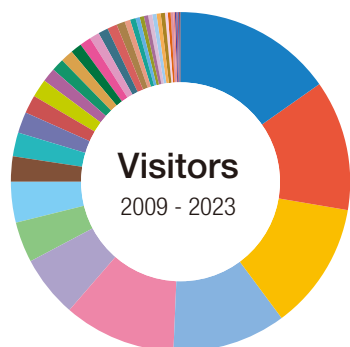
Major Publications

S. H. Joo, Y. B. Jeong, T. Wada, I. V. Okulov, H. Kato
"Inhomogeneous Dealloying Kinetics Along Grain Boundaries During Liquid Metal Dealloying", *J. Mater. Sci. Technol.* 106 (2022) 41-48

D. Aoki, H. Sakai, P. Opletal, Y. Tokiwa, J. Ishizuka, Y. Yanase, H. Harima, A. Nakamura, D. X. Li, Y. Homma, Y. Shimizu, G. Knebel, J. Flouquet, Y. Haga
"First Observation of the de Haas-van Alphen Effect and Fermi Surfaces in the Unconventional Superconductor UTe₂", *J. Phys. Soc. Jpn.*, 91(2022) 083704

J.-J. Wen, W. He, H. Jang, H. Nojiri, S. Matsuzawa, S. Song, M. Chollet, D. Zhu, Y.-J. Liu, M. Fujita, J. M. Jiang, C. R. Rotundu, C.-C. Kao, H.-C. Jiang, J.-S. Lee, Y. S. Lee
"Enhanced Charge Density Wave with Mobile Superconducting Vortices in La₁₋₈₈₅Sr_{0.115}CuO₄", *Nat. Commun.*, 14(2022) 733

🌐 Visitors supported by ICC-Programs



USA 114	Switzerland 18	Iran 8	Brazil 3	Romania 2
China 93	India 17	Spain 8	Czech Republic 3	Vietnam 2
Germany 91	Poland 15	Mexico 7	Slovakia 3	Argentina 1
France 81	Canada 13	Thailand 7	Slovenia 3	Egypt 1
Korea 80	Taiwan 13	Denmark 7	Sweden 3	Nepal 1
UK 44	Norway 10	Hong-Kong 6	Indonesia 3	Serbia 1
Netherlands 29	Australia 9	Belgium 4	Ukraine 3	Turkey 1
Russia 29	Singapore 9	Italy 4	Austria 2	

🌐 ICC-IMR Programs

ICC-IMR was founded in April 2008 as the center for international collaboration of the Institute for Materials Research (IMR). As one of the centers of excellence in materials science, IMR holds 27 research groups and five research centers. ICC-IMR works as a gateway of diverse collaborations between international researchers and IMR members. ICC-IMR has invited 86 visiting professors and conducted 23 international research projects since the start-up. The applications are open for foreign researchers and the projects are evaluated by a peer-review process involving international reviewers. Currently, ICC-IMR coordinates five different programs:

- 1 International Integrated Project Research
- 2 Visiting Professorships
- 3 International Workshops
- 4 Fellowships for Young Researchers and PhD Students
- 5 Material Transfer Program

We welcome applicants from around the globe to participate in these international programs.

🌐 Illustrative Case of Featured Program “Covis” (Co-research Visit)

Covis is a team visit program combined with Long (Visiting Guest Professor by ICC-IMR) and Short (Single Research Visit by GIMRT) stay, started from 2022.

For the 1st case, IMR invited 2 researchers from CNRS, France. They proceeded the experiments with very close discussion with HFLSM (High Field Laboratory for Superconducting Materials) researchers under the theme, “High temperature superconductors for very high field magnets beyond 30 T”. Effective collaboration with Covis scheme led to publish a paper, DOI: 10.1109/TASC.2023.3242219. Furthermore, the CNRS and HFLSM organize an international workshop on the theme to form a strong and sustainable research partnership.



Visiting Assoc. Prof. BADEL (Left) and Dr. VIALLE (Right) from CNRS, with a Test module for High Tc Superconductor Coil



The 7th French-Japanese High Field Research Collaboration Workshop (March 8-10, 2023)

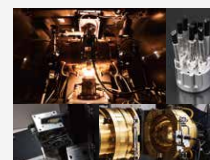


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On the Cover

High quality single crystals grown by Traveling-solvent floating-zone method
 Photo Credit: Fujita Laboratory, IMR





ICC-IMR Director
**Hiroyuki
NOJIRI**

Top Message

In November 2023, IMR held the 6th Summit of Materials Science, SMS 2023. The international conference SMS was created in 2012 to appeal the recovery from the Great East Japan Earthquake. It is for the academic exchange based on the idea that strong international cooperation in the field of materials science is essential to create better human society.

With the development of the Internet technology, communication has been freed from the constraints of place and time. In such age, why do people need to travel long distances to meet up? In the first place, traveling brings us the joy of experiencing new things with our full senses. Encountering new materials, understanding things from different perspectives, and most of all, meeting new people, these things would not be possible without travel. And the most important point is that unplanned or unexpected encounters lead us to new worlds.

My field of expertise, magnetism, deals with many phase transitions. Phase transition is essentially a cooperative phenomenon, and it appears the properties that would never appear in individual atoms or molecules. In another word, the interactions among particles are necessary to

cause phase transitions. This is why we see an almost infinite variety of states in our world, even though the universe is made up of a limited number of elements. I believe that such many-body effect is what we expect for international conferences. Unfortunately, or fortunately, many-body interactions would be difficult even with today's most advanced communication technologies.

Why researchers have almost infinite topics to discuss with each other in conferences? It is because we share a common ground of fact and truth and an inexhaustible fuel of curiosity. ICC-IMR has supported workshops, guest professorships, fellowships, conference attendances to support such activities. As a first attempt this year, ICC-IMR supported the travel of 6 students overseas and held a materials science school for young generation in overseas. Through these new efforts, we will contribute to building new relationships among next generation researchers from all over the world.

ICC-IMR believes that academic exchange is important and necessary activity in today's divided world, and that it plays a role in connecting the world for better futures.

❖ Comments from a Visiting Professor



Anna KOSOGOR
Institute of Magnetism

It was a truly enriching experience to spend six months at the Cooperative Research and Development Center for Advanced Materials at IMR in 2023. Our collaboration with Prof. Rie Umetsu began in 2020, and the focus of our work was to combine experimental and theoretical studies, aiming to gain a comprehensive understanding of different physical phenomena accompanying phase transitions in martensitic alloys. Within the Institute of Magnetism, our primary emphasis is on theoretical research in magnetism and materials science. My expertise lies particularly in the phenomenological description of phase transitions and the functional properties of multiferroics. The purpose of the present visit

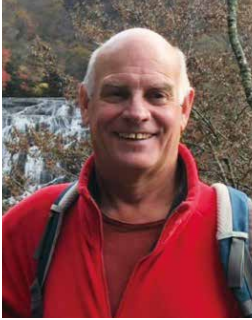
was to analyze the influence of chemical composition on the magnetic properties, phase diagram, and low-temperature specific heat of metamagnetic Ni-Mn-based shape memory alloys.

I was incredibly impressed by the experimental capabilities and the variety of research topics being conducted at IMR. The people there are passionate about their work and possess a broad scope of knowledge. It was truly enjoyable for me to be part of such an exciting and motivating atmosphere.

My onsite visit at the IMR was a pleasure, providing valuable insights into modern research in Japan. Moreover, I thoroughly enjoyed immersing myself in Japanese culture and appreciating the local attitude towards science and research.

I extend my sincere gratitude to Prof. Rie Umetsu and the IMR for providing me with this invaluable opportunity to visit and collaborate.

❖ Comments from a Visiting Professor



Daniel BRAITHWAITE
CEA Grenoble, FRANCE.

Although I have collaborated closely with professor Dai Aoki for more than 20 years, this was my first opportunity to visit the IMR lab in Oarai for a significant period and carry out research here. Our program was quite ambitious: to start to perform measurements in a new compact diamond anvil pressure cell that has been designed and constructed in Grenoble. Professor Aoki's lab is impressively equipped for performing experiments in extreme conditions of low temperatures and high magnetic fields. However, at present this kind of pressure cell is not used, and quite a lot of preparations were necessary. Due to the kind welcome and large expertise of all the members of the group it was possible to do this efficiently and quickly. The lab is now rather well prepared to use diamond anvil cells, with the possibility to liquefy argon, and to measure ruby fluorescence at

liquid nitrogen temperatures. My 6 week stay, during which one of our PhD students from Grenoble was also able to visit for 3 weeks, was sufficient to finish this preparatory work and perform the first measurements on a sample of UTe_2 in the new pressure cell. Using the Dynacool PPMS system we performed calorimetry measurements under pressure at low temperature and under magnetic field with the possibility to rotate the pressure cell and so study the effect of the field orientation in relation to the sample's crystallographic structure. This is, to my knowledge, a first worldwide, and an extremely powerful technique for the extremely anisotropic superconductor UTe_2 , allowing us to determine the angular dependence of the critical field under pressure and so gain information on the effect of pressure on the effective mass and the band structure. These important results open huge possibilities for our future collaborations.

This visit was also a marvelous opportunity to learn from the efficient organization and working attitude in the laboratory, and also to discover and enjoy the beautiful surroundings and rich culture of Ibaraki.



❖ Comments from visitors



Basit Ali
PhD student,
Department of Civil and Mechanical
Engineering, Technical University of
Denmark (DTU), Denmark.

As a recipient of the ICC-IMR fellowship award, I had the incredible opportunity to spend two months as an external researcher at Furuvara Lab. This experience was truly a once-in-a-lifetime chance. The lab contains state-of-the-art facilities and was populated by incredibly kind, intelligent, and hardworking individuals who not only taught me a great deal but also made my time in Japan truly enjoyable. They generously assisted me not only with my research and experiments but also in understanding Japanese culture and lifestyle. Particularly, the guidance and support from Professor Dr. Tadashi Furuvara and Professor Dr. Goro Miyamoto greatly enriched my comprehension of my PhD project and research outcomes. I feel immensely honored, inspired,

and fortunate to have been part of such an outstanding laboratory.

Despite my short stay, I made significant progress. My focus was on characterizing the martensite microstructure in a nitrogen-stabilized precipitation-hardenable steel alloy using techniques like TEM and EBSD. Specifically, I investigated the variant pairing tendency in developed martensite and its correlation with nitrogen content. The quality of the results I obtained enhanced my overall understanding of the research I had conducted at DTU. Outside the lab, Sendai city's fusion of modernity and tradition captivated me. Exploring the city's vibrant atmosphere and historical sites was a delightful experience. Additionally, I had the chance to join the annual lab trip to Urabandai active resorts in Fukushima, which exposed me to some of the best and breathtaking natural beauty I have ever experienced. Overall, Japan's rich cultural heritage, blending centuries-old traditions with technological advancements, left an indelible mark on me.

In closing, my deepest gratitude extends to ICC-IMR and the entire Furuvara Lab for their warm hospitality. I eagerly anticipate future collaborations, nurturing new projects, and knowledge exchange between Furuvara Lab and my team at DTU, Denmark.

Summit of Materials Science SMS 2023 and Global Institute for Materials Research Tohoku (GIMRT) User Meeting 2023 , November 20-22, 2023



The 6th SMS was successfully held at IMR auditorium with almost 200 of participants (including online participants) in 3 days from November 20 to 22. All speakers gathered in a hall after an interval of four years since the last onsite meeting of 4th SMS held just before the pandemic.



The Conference started with the welcome greetings by Prof. Takahiko Sasaki, Director of IMR, Prof. Hideo Ohno, President of Tohoku University and Mr. Koji Yanagisawa, Director of Scientific Research Institutes Division, MEXT (Ministry of Education, Culture, Sports, Science and Technology). The auditorium was fulfilled with over a hundred of participants from all over the world.

The conference was divided in 9 fields, "Superconductivity", "Quantum Materials", "Exotic Spin Systems", "Material Design and Informatics", "Spintronics and Topological Phenomena", "Functional Materials", "Nuclear and Irradiation", "Advanced Metallurgy – 3D Printing and Nanomaterials" and "Hydrogen Materials". A hot discussion was exchanged at every field, and a discussion sometimes extended for a break. In the evening of 2nd day, the poster session was held. Researchers and students presented their recent research topics. The discussion was overflowing with excitement and enthusiasm and continued until late at night.



The total number of speakers were 48 this time. 20 were invited, in which 11 were from overseas, and 28 were contributed or short speakers. Not only senior researchers, but also young and energetic speakers expressed lively their recent cutting-edge research topics.

