

Conferences and Workshops

9th International Discussion Meeting on Relaxations in Complex Systems (9IDMRCS)

August 12-18, 2023

O. Yamamuro, K. Mayumi, H. Noguchi, H. Tanaka, and H. Shirota

9IDMRCS was co-sponsored by ISSP (as ISSP International Workshop) and held at the Makuhari Messe International Conference Center. The number of registered participants was almost the expected number of 621, but it was gratifying to see that more than half (347) were non-Japanese, despite the fact that COVID-19 was still in effect. The conference was a very successful and financially sound one, supported by 10 academic societies, 41 companies and research institutes (including financial support), and generous financial support from Chiba Prefecture, Chiba City, the Japan Tourism Agency. The first day of the conference opened with keynote lectures by five distinguished researchers on the main themes of the conference, i.e., the glass transition and the dynamics of polymers, proteins and granular materials. This was followed by a symposium (3 speakers) in honor of Professor Austen Angell, who passed away in 2021, and a memorial lecture for Professor Uri Buchenau, who passed away just before the conference. Both have contributed greatly to the conference over the years. Parallel sessions in seven rooms were held over the second through the seventh days. The number of presentations was 354 invited talks and 102 general presentations. Poster sessions (146 presentations in total) were held in the afternoons of days 4 and 6. The program consisted of 40 symposia which were organized by about 100 symposium leaders. In addition to the previous topics such as glass transition, water/hydrogen-bonded liquids, ionic liquids, polymers, gels, colloids, bio-related materials, surfaces, ion-conductive solids, intermediate phases (liquid crystals and plastic crystals), high-pressure measurements, and state-of-the-art measurements, this conference added new topics that have rarely (or never) covered inorganic glasses, metal glasses, spin glasses, electronic glasses, granular materials, active matter, pharmaceuticals, foods, MOFs, energy storage/conversion materials, etc., providing a forum for comprehensive discussion of relaxation phenomena in an increasingly diverse range of subjects. This conference also focused on booth exhibitions. 22 booths were set up in the same main hall as the poster area (and rest area), where companies, research facilities, and Grant-in-Aid groups introduced their products and activities. The social program was also well organized, with a Welcome Party on the first day, a tea ceremony and Ukiyo-e viewing tour for the accompanying guests on the third and fourth days, an excursion (3 courses: Tokyo, Nokogiri-Mt., Sawara) on the fifth day. The Banquet, which was held on the 6th day, was a groundbreaking event in which we rented out the Mihamaen Japanese garden to enjoy the beautiful garden and festival night stalls together, which was appreciated by many participants.



Hierarchical Structure and Machine Learning 2023

October 2-13, 2023

O. Sugino, J. Haruyama, R. Akashi, T. Yokota, and R. Nagai

The physics of interacting particle systems is characterized by a hierarchical structure of many-body correlation functions. Density functional theory (DFT), one of the central themes of this workshop, has been developed independently for classical, electronic and nuclear systems, but they are all based on this hierarchical structure, and it is believed that common techniques hidden in these systems can be shared for their development. The aim of the workshop was to discuss and deepen understanding of this issue, and various techniques for overcoming hierarchy-based complexity were presented. The workshop featured 11 speakers working at the cutting edge of research, offering the audience two lectures a day on topics ranging from the fundamentals of the research field to recent findings. Among the topics covered were function renormalization group (FRG) methods that link different hierarchical levels and scales; applications of FRG methods to classical fluid and electronic systems were discussed, and the theory was compared with powerful DFT-based nonperturbative and time-dependent power functional approaches. Another important topic was dynamic mean-field theory (DMFT), which can handle many-body correlations beyond the typical two-particle level of conventional DFT. Applications to cuprate and nickelate superconductivity were discussed. For superconductivity, some of the refinements to the DFT approach were also presented: the diagrammatic approach as well as the path integral approach for phonon-mediated superconductivity were discussed. Particular attention was also paid to the hierarchical equations of motion developed for non-equilibrium systems. Numerically rigorous methods were developed to overcome the complexity inherent in the Feynman-Hibbs-type path integral approach due to its hierarchical nature. Finally, new theoretical schemes based on AI and machine learning were discussed. Breakthroughs in density functional development and materials design were presented. The symposium part of the workshop enabled young researchers to present their results in oral or poster form. Intensive discussions took place between young and established researchers. Researchers from different disciplines focused on the specific topics and learned the different computational schemes developed, stimulating speakers and audience alike to take new leaps forward.

Hierarchical Equations and Machine Learning

October 6-10, 2023

O. Sugino, J. Haruyama, R. Akashi, T. Yokota, and R. Nagai

This workshop was organized as a satellite of the international workshop entitled HIERarchical Structure and Machine Learning (HISML2023). It enabled young researchers to present and discuss their results with the professors invited to HISML2023. The central theme of this year's workshop was the numerical study of many-body correlation problems. Active discussions took place on problems such as (a) superconductivity vs. hyperperiodicity, (b) finite-temperature geometry optimization, (c) structure determination based on data assimilation, (d) machine learning beyond neural networks and kernels, (e) inverse Hamiltonian design, (f) superconductivity in iron-based materials, (g) antiferromagnetism in high-throughput calculations, (h) DFT studies of excitonic insulators, (i) studies of vibrational properties using machine learning, (j) non-equilibrium energy flows using dynamic mean fields, and (k) DFT studies of solid oxygen. These studies include new research topics made possible for the first time by data science-based approaches and/or new developments in many-body theory. The activities of young researchers, who represent the promise of the future, received particular attention at the workshop.



Annual Meeting of MDCL Supercomputer Center and CCMS —Condensed Matter Physics in the Era of Computation—

April 3-4, 2023

N. Kawashima, T. Ozaki, O. Sugino, H. Noguchi, T. Fukushima,
K. Ido, H. Nakano, J. Haruyama, M. Fukuda, and K. Yoshimi

This is an annual meeting where the uses of ISSP joint-use supercomputers (currently, "ohtaka" and "kugui") meet each other where a member of the institute's computer-related staff takes turns serving as the representative organizer. The current total theoretical computing power of the ISSP joint-use supercomputer is about 8 PF. This year, it was the first time in three years that the meeting was held completely on-site, and there was some concern that the number of participants would be too high or low, as the rules on the maximum number of people allowed in the conference room still remained. It turned out that 60 people actually attended on April 3rd and 55 on the 4th. There was lively discussion following each presentation. There were 16 invited oral presentations, including two special talks by Arita (The University of Tokyo) and Furuya (NVIDIA), and 25 poster presentations. The poster session and a small social gathering that followed provided a good opportunity for the first time in a long time to promote in-person interaction among community members. For the posters, the three posters were selected by a vote of all participants as the winners of the Excellent Poster Award, and an awards ceremony was held at the end of the meeting. We would like to thank the external members of the program and organizing committees: T. Uneyama (Nagoya U.), Y. Hatsugai (U. Tsukuba), S. Watanabe (U. Tokyo), M. Kawamura (U. Tokyo) and S. Morita (Keio U.)



Frontier of New Materials Research: Novel Electronic Properties and Functions Based on Characteristic Approaches

May 15-16, 2023

Y. Okamoto, T. Ideue, J. Yamaura, and H. Kageyama

This workshop was organized for participants to share the new methods, approaches, and directions that have recently been found in the research on materials science. The impact of the discovery of unprecedented new materials is significant for materials science. New materials can generate novel phenomena and functions, propelling materials science research and inspiring the next generation of researchers. However, it is not easy to get an overall picture of which studies in a wide range of research fields are generating innovations related to new materials. Research on new materials frequently divides and organizes itself based on functions, phenomena, and target material systems. Therefore, we organized a hybrid-style workshop focusing on recent materials research related to new materials spanning a wide range of fields on May 15th and 16th. As many as 145 people registered for the workshop and 45 attended on-site, where participants engaged in lively discussions. In addition to 18 invited talks and 3 comments, a special lecture was given by Prof. Takehiko Yagi.



Recent Developments in Measurement Techniques with Pulsed Magnetic Fields for Condensed Matter Physics

June 22-23, 2023

K. Kindo, Y. H. Matsuda, M. Tokunaga, and Y. Kohama

This workshop was organized for the high magnetic field research community, especially for the users of the International MegaGauss Science Laboratory (IMGSL) in ISSP. We had some comments from the Advisory Committee for Joint Usage in ISSP that it would be necessary for users to have some tutorial lectures and some practice of the experiment. This workshop was planned to address the comments. The program consists of (1) the lecture part and (2) the experiment part. Basics of the experimental techniques required to use pulsed magnetic fields were first given. Subsequently, several specific measurement techniques for thermal, magnetic, electrical, and mechanical properties of matter. Several means using electric, optical, and acoustic signals were introduced. In the second part of the workshop, four kinds of pulsed-field experiments were demonstrated with attendees. Two of them were done with non-destructive magnets, and the other two utilized destructive magnets, namely the horizontal and vertical single-turn coils. The number of participants was limited to around 50 so that the experiments were conducted safely. According to the questionnaire, it seemed that attendees felt they had valuable time to experience real pulsed magnetic field experiments.



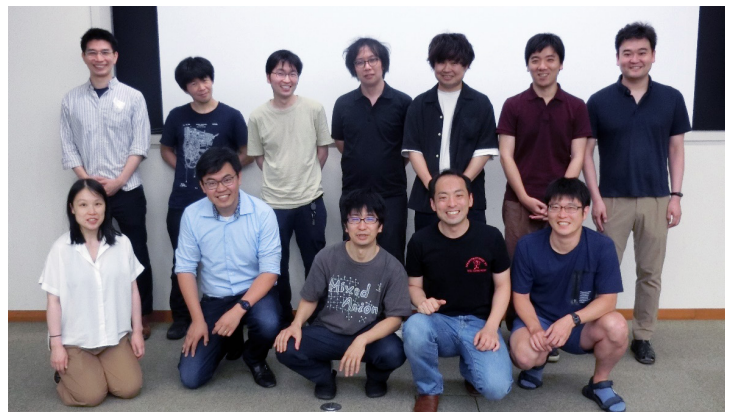
Metastability from an Interdisciplinary Perspective

July 4, 2023

T. Oka, R. Takagi, and H. Oike

The recent workshop on metastability brought together researchers, including 7 invited speakers, from different disciplines to explore this complex phenomenon. Metastability, which manifests differently across various fields, is crucial in both solid state physics and chemistry. In solid state physics, it appears in photo-induced phase transitions and hysteresis during parameter sweeps (temperature, magnetic field, pressure). In chemistry and metallurgy, metastable phases are achieved through low-temperature synthesis, rapid cooling, and high-pressure synthesis. Understanding metastability across different time and spatial scales in various materials remains a significant challenge in non-equilibrium systems physics. The workshop aimed to bridge the gaps in understanding by fostering interdisciplinary discussions and collaborations.

The talks covered metastable states induced by light, heat, magnetic fields and strain, as well as general laws for metastable materials based on first-principles calculations and data science. There were 15 on-site participants and about 30 online participants, and active discussions continued after lunch and the talks, generating many ideas for collaborative research. A highlight of the workshop was a tour at the International MegaGauss Science Laboratory at ISSP. This tour introduced participants, especially those less familiar with condensed matter experiments, to cutting-edge facilities. The workshop underscored the growing synergy between materials science and physics, emphasizing that the field of metastability would benefit from greater involvement of condensed matter physicists for further advancements.



ISSP Joint Research Results Presentation Meeting 2023

September 7, 2023
Joint Research Program Office (Kyodo Riyou Gakari)

Joint Research Program is one of the most crucial functions of the Institute for Solid State Physics (ISSP). This symposium was organized to share the results achieved through the Joint Research Program at ISSP and to foster future collaborations. The program included four invited lectures: two by external and two by internal speakers. From outside ISSP, Prof. Kanazawa from the Institute of Industrial Science at The University of Tokyo presented his research on the properties of magnetic devices in collaboration with the Neutron Science Laboratory. Prof. Hashimoto from the Graduate School of Frontier Sciences at The University of Tokyo discussed his research on superconductivity under high pressure, conducted in collaboration with the Materials Design and Characterization Laboratory. From within ISSP, Dr. Imajo from the International MegaGauss Science Laboratory and Prof. Kondo from the Laser and Synchrotron Research Center showcased their work on ultra-high magnetic fields and angle-resolved photoemission spectroscopy, respectively.



Spectroscopic Revolution by Cooperative and Constructive Relationships between High Harmonic Laser and Synchrotron Radiation

September 30, 2023
Y. Harada, Y. Kobayashi, I. Matsuda, T. Kimura, T. Kondo, K. Okazaki, R. Matsunaga, K. Inoue, T. Taniuchi, T. Kisu, K. Ishizaka, Y. Tezuka, and T. Yokoya

In 2012, Laser and Synchrotron Research (LASOR) center was established to promote collaborative research among high-harmonic laser and synchrotron radiation communities. Prof. Shik Shin, who played a crucial role in LASOR's establishment and development, passed away in June 2022. This workshop was held to honor his contributions and discuss the future of materials research. The first part of the workshop focused on his achievements from the SOR-RING in the early days of Japanese synchrotron radiation to the birth of LASOR, and in particular discussed the development of synchrotron radiation soft X-ray spectroscopy and high-harmonic laser photoelectron spectroscopy. The second part explored the potential of combining laser and accelerator technologies for materials research. Special attention was given to Laser PEEM, a next-generation microscope combining high-order harmonic lasers and photoelectron microscopes, which was the final project of Prof. Shin. The workshop concluded with discussions and proposals on the future of LASOR at ISSP and the direction of Japanese photonics research, emphasizing the importance of continued innovation and collaboration in this field. Following the six invited lectures, a memorial event was held, attended by approximately 130 researchers who had been associated with Prof. Shin.

3rd Workshop on the Frontier and Future Trends in Nanoscale Science

October 6, 2023

M. Hashisaka, T. Ideue, Y. Otani, T. Osada, T. Kato, Y. Hasegawa, R. Matsunaga, and S. Miwa

Advances in nanoscale fabrication and measurement techniques have led to cutting-edge experiments that capture the essence of microscopic phenomena in condensed matter. We organized this workshop to provide an overview of this ever-growing research field, following the first and second workshops held in 2020 and 2021. This workshop consisted of three sessions, and ten young researchers were invited to give talks. The first session focused on quantum information technology, the second on the novel functionalities of new materials and devices for future technologies, and the third on signal processing using new device architectures. Although all the lectures were at the cutting edge of research in their respective fields, the speakers were considerate to the audience, which included individuals with a wide range of backgrounds, and provided clear explanations. Thanks to their efforts, the objective of this workshop, which aimed to facilitate cross-disciplinary information exchange with nanoscale science as the keyword, was fulfilled. A total of 138 people, including 42 on-site and 96 online, attended the workshop. Active discussions between the participants, particularly on-site, provided great opportunities to exchange information, which will stimulate and advance extensive studies in the future.



ISSP Women's Week 2023

November 25-December 1, 2023

I. Matsuda, T. Ideue, Y. Otani, T. Oka, K. Okazaki, M. Oshikawa, M. Tokunaga, T. Nakajima, T. Fujino, M. Horio, J. Yamaura, and M. Lippmaa

In promoting diversity activities, ISSP organized "ISSP Women's Week 2023" from November 25 – December 1, 2023. The week focused on active participation of women in the workforce as well as work-life balance. It started with an event for female undergraduate and graduate students, followed by FD/SD training and division/facility seminars with female researchers as instructors. On the last two days, a workshop was held with invited lectures by researchers active in various fields, round-table discussions, and poster sessions. When the workshop concluded, a ISSP tour was held according to the participants' wishes. Through the week, the events were held with various styles, face-to-face, online, and hybrid. There were over 300 participants who discussed various topics, including interdisciplinary research, life event, and work efficiency. The week was supported by KIOXIA Holdings Corporation and by the MEXT Academic Transformative Research (A) project "Chemical Catastrophe in Ultra-Strong Magnetic Fields of 1000 Tesla: Science of Chemical Bonding in Non-Perturbative Magnetic Fields".



How High Can We Raise Thermoelectric Performance?

December 5-6, 2023
T. Mori

This Workshop dealt with recent experimental and theoretical advances in thermoelectric materials research based on the understanding of condensed matter properties. There was a Keynote Talk by Prof. Hidetoshi Fukuyama and 28 Invited Talks and 9 Poster Presentations. In addition to Peltier cooling, thermoelectric materials can directly convert thermal energy into electricity due to the Seebeck effect. They can be valuable for energy saving via waste heat power generation and as stand-alone power sources for innumerable sensors. There are paradoxical requirements between the physical parameters, namely between the Seebeck effect and electrical conductivity, and between the thermal and electrical conductivity. Therefore, it is generally not easy to improve performance. Various novel thermoelectric enhancement strategies leading to extremely high figure of merits and power factors were presented at the Workshop. Theoretical advances, for example, a quantum mechanical approach, the “thermoelectric linear response theory” (Kubo-Luttinger theory) were also presented, together with progress made in novel material systems such as topological materials, carbon nanotubes, and organic materials. At the Workshop there were intensive and exciting discussions, with around 100 participants in a full room, and new challenging perspectives in the field were opened up.



Surface and Interface Spectroscopy 2023

December 20-21, 2023

R. Arafune, H. Okuyama, Y. Kim, T. Komeda, T. Kondo, T. Sugimoto, N. Takagi, A. Nakajima, T. Yokoyama, K. Watanabe, T. Ozaki, O. Sugino, Y. Hasegawa, I. Matsuda, and J. Yoshinobu

Surfaces and interfaces are becoming increasingly important not only from the viewpoint of basic science such as the surface states of topological materials but from the applications such as catalysts, solar cells, fuel cells, secondary batteries and various devices that can solve the issues in the global environment, energy, information technology, etc. This is because the surface and interface are the fields of energy exchange and reactions. Recent advances in experimental techniques and first-principles calculations have made it possible to investigate not only the ideal model surfaces but also the complex surfaces of real materials under the operating conditions in atomic scale. This ISSP workshop featured the recent experimental and theoretical studies on surface and interface spectroscopy, including surface vibrational spectroscopy, local probe microscopy/spectroscopy, surface nonlinear spectroscopy, photoelectron spectroscopy, and synchrotron radiation spectroscopy. The purpose of the workshop was to promote mutual understanding among researchers with diverse backgrounds through discussion and to generate new collaborative research.

We had 5 invited lectures, 8 contributed talks, 8 oral presentations for student award applications, and 47 poster presentations. 128 people registered in advance; the actual number of participants was 110 on December 20 and 81 on December 21.

The program and abstracts can be downloaded from https://yoshinobu.issp.u-tokyo.ac.jp/ISSPWS_SIS2023.html



The 1st U-Tokyo ISSP • RIKEN CEMS Collaboration Workshop

January 24, 2024

Z. Hiroi, T. Arima, M. Tokunaga, T. Nakajima, M. Hahsisaka, and Y. Otani

The Institute for Solid State Physics (ISSP), established in 1957, has long been a central player in Japan's condensed matter science research. The RIKEN Center for Emergent Matter Science (CEMS), founded in 2013, brings together top researchers in physics, chemistry, and electronics to study emergent phenomena and their applications. Both institutes are dedicated to developing innovative materials and theories for the benefit of future society.

This workshop emphasized the importance of ISSP and CEMS collaborating to enhance Japan's research capabilities amidst growing international competition. Another goal was to identify potential research projects that could gain global recognition. Given the significant number of foreign researchers at CEMS, English was chosen as the workshop's common language, facilitating participation from Japanese and international researchers and students.

The event began with remarks from the ISSP director, followed by research presentations from both institutes highlighting their joint research achievements. Recent research results were shared, sparking extensive discussions. The afternoon session focused on recent findings in each institute's specialized fields, clarifying strengths and common research themes. Active exchanges of ideas on new research directions were held, aiming to foster new collaborative projects. Post-conference, exchanging opinions among organizers and speakers reinforced the decision to hold future workshops alternately at ISSP and CEMS.

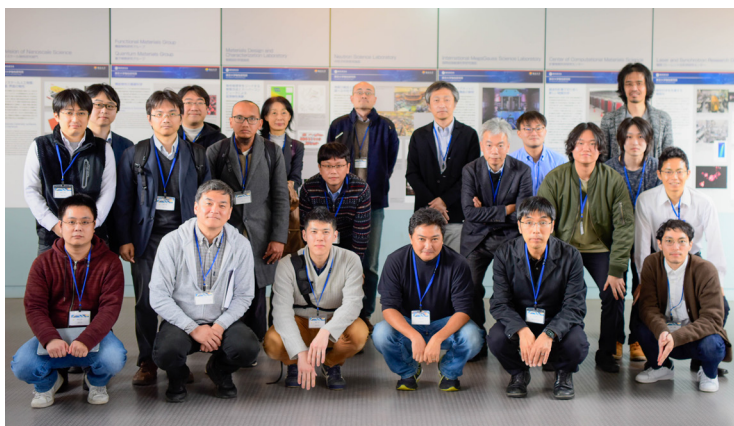


Data Integration between Simulations and Advanced Experiments in Materials Science

February 19-20, 2024

T. Hoshi, I. Matsuda, T. Misawa, K. Yoshimi, T. Ozaki, and N. Kawashima

A current trend in material science is the data integration between simulations and advanced experiments. The aim of this workshop is an overview of the data integration in materials science and its future prospects. The workshop is composed of 11 invited talks, 2 contributed talks and 18 poster presentations. The number of applicants is 78, including 28 on-site participants. The number of participants in the reception was 20. The plenary talk was given by Masahiko Demura (NIM) with the title of 'Towards the realization of the Materials DX platform concept'. The other invited talks were focused on the systematic data collection and application studies using simulations by Yu Kumagai (Tohoku U.), Tetsuya Fukushima (AIST), Takashi Koretsune (Tohoku U.) and Masahiro Fukuda (U. Tokyo) and on two-dimensional materials by Tadashi Abukawa (Tohoku U.), Yuki Fukaya (JAEA), Shu-Jung Tang (National Tsinghua U.), Junji Yuhara (Nagoya U.), Takeshi Nakagawa (Kyushu U.) and Takeo Hoshi (NIFS). There were presentations from both experimental and computational research and lively discussions took place. The co-organizers of the workshop are National Institute for Fusion Science (<https://www.nifs.ac.jp/>) and DxMT CoLabo (<https://dxmt.mext.go.jp/>).



Interdisciplinary Collaboration between Theoretical and Experimental Approach: Luciferin-Luciferase Reaction

March 8-9, 2024

M. Hiyama, T. Nakatsu, S. Maki, Y. Noguchi, O. Sugino, O. Yamamuro, and H. Akiyama

Bioluminescence, which is the luminescence reaction between a substrate (luciferin) and an enzyme (luciferase), is widely used for investigation of temporal changes in cell proliferation, observation of drug and cancer cell metastasis pathways, detecting microbial pollutions in food hygiene testing, and so on. Because of their usefulness, protein mutants and substrate analogues for different emission color have been developed as luminescence probes using bioluminescence. In this ISSP workshop, the experts in organic synthesis, theoretical calculations, and quantitative measurements introduced the latest research results on luciferin-luciferase reactions for not only extant fireflies but also ancient fireflies and other luminescent organisms. The methods to detect pesticide residues by firefly bioluminescence and the development of immunoassay elements using bioluminescent enzymes of marine organisms were also presented. In the last session, there were presentations for the studies on cell experiments and experiments using human models and the issues for new applications of bioluminescence were pointed out. There were 15 invited lectures and eleven poster presentations were given as general lectures. Total attendance of this workshop was 76.



Future of Organic Conductors through Device Applications

March 26-27, 2024

T. Ideue, H. Oike, Y. Okamoto, R. Takagi, T. Fujino, and S. Miwa

Organic conductors have been extensively investigated because their low dimensionality and strong electron correlations give rise to emergent phenomena. In organic semiconductors and organic polymers, device fabrications have been developed to realize organic electronics. Recently, such device technology has been applied to organic conductors, enabling electrical control of emergent phenomena. Because organic conductors are difficult to synthesize, measure, and microfabricate, collaborations, and also because emergent phenomena are difficult to understand and predict, collaboration among the fields of chemistry, physics, and engineering is essential for the future development of the research of organic conductors.

This workshop invited 29 speakers, mainly young researchers from a wide range of research fields relating to "molecule", such as organic conductors and semiconductors, organic electronics and spintronics, inorganic van der Waals crystals, and graphite. Each lecture covered cutting-edge topics as well as the basic research concept in the respective fields. The workshop aimed to promote close discussion and interaction among researchers with diverse backgrounds in physics, chemistry, and engineering. On the day of the event, many questions were asked by participants from different research fields, and active discussions were held after the lectures and during the breaks. There were also some occasions when new perspectives and research directions emerged from simple questions posed by audience members outside of their fields of expertise. There were 35 on-site participants and about 50 online participants.



