

Conferences and Workshops

The International Summer WorkShop 2018 on First-Principles Electronic Structure (ISS2018)

July 2-12, 2018

T. Ozaki, F. Ishii, H. Weng, M. J. Han, M. Otani, M. Kawamura, C.-C. Lee, M. Fukuda, and Y.-T. Lee

The international summer workshop was organized in July, ISSP, the University of Tokyo to discuss recent advances of first-principles electronic structure methods and its advanced applications, and to promote international collaborations in the community, where in total 118 participants including 64 participants from abroad joined the workshop. In addition to the local organizing committee, Prof. Ishii of Kanazawa Univ., Dr. Otani of AIST, Prof. Han of KAIST, and Prof. Weng also contributed to the organization. The international workshop consisted of three parts: (i) The Summer School on DFT: Theories and Practical Aspects for July 2-6, (ii) The 3rd OpenMX developer's meeting for July 9-10, and (iii) Advanced Lecture Series for July 11-12. In the first part, fundamental issues and practical aspects of density functional theories (DFT) calculations were discussed by 15 lectures including pseudopotential theories, implementation of DFT, large-scale DFT methods, computational methods of absolute binding energies of core level, and generation of Wannier functions. Advanced applications such as topological insulators and lithium ion batteries were also discussed. In the second part, recent methodological development and applications related to the OpenMX DFT code that ISSP has been developing were presented by developers and advanced users to promote further collaboration of the community. The developments of the DC-LNO $O(N)$ method and optical properties calculations were presented by 17 speakers. In the third part, six leading researchers gave the advanced lecture series covering methodological developments in computational physics and chemistry and its application to a wide variety of materials having not only fundamental significance and but also industrial importance. The Advanced Lecture Series highlighted the current status of first-principles electronic structure calculations and indicated a future direction of the field. In addition to this, there was a poster session of contributed participants to enhance active discussion.



The 16th International Conference on Megagauss Magnetic Field Generation and Related Topics | ISSP International Symposium

September 25-29, 2018

S. Takeyama, Y. H. Matsuda, B. Novac, and Y. Kohama

This international conference is a series of the Megagauss conferences and was held in Japan for the first time. The conference venues are Kashiwa-no-ha Conference Center in Mitsui Garden Hotel (main venue) and The Future Center Initiative of the University of Tokyo (poster venue). Both venues are located close to the Kashiwanoha railway station of the Tsukuba Express. There are 108 participants in total including 61 participants from USA, Russia, China, Europe, and India. The topics of the Megagauss conferences are (i) generation of ultrahigh magnetic fields, (ii) high-energy and high-current pulsed power physics and technology, (iii) magnetic-flux compression technologies and their applications, (iv) high energy density physics related to fusion research, (v) high magnetic field applications in solid-state physics and for other related applications. In previous Megagauss conference, however, only a very small number of presentations have been made in solid-state-physics domain. One of the purposes to have this series of conference in Japan is to promote exchange more between researchers of pulsed power sciences and solid state physicists. The organizers encouraged not only domestic but also international solid state physicists to participate the conference. In the conference we had 42 oral and 57 poster presentations. When we count the numbers of solid-state-physics-related presentations of them, they are 15 and 37, respectively, and the numbers are considered to be large enough to boost exchanges between the pulse power and solid state physics scientists. The leaders of high magnetic field facilities of Germany, France, USA, and China presented recent results on high field properties of magnetic materials, semiconductors, superconductors, and strongly correlated systems as well as current status of their facilities. It should be noted that progress of Chinese research groups in both solid state physics and pulse power science domains is impressive. It is also found that computer simulation on high-density plasma and pulse power technology has been highly developed.



Topological Phases and Functionality of Correlated Electron Systems 2019

February 18-20, 2019

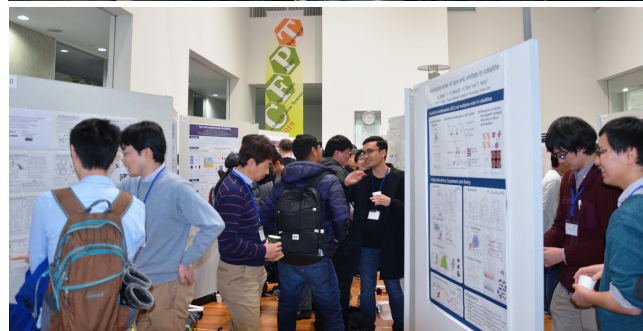
S. Nakatsuji, Y. Otani, M. Oshikawa, C. Broholm, H. Harima, S. Miwa, and H. Wadati

For a long time, magnetism has been a central subject in strongly correlated electron systems. More recently, topology led to a new classification of band insulators, namely topological insulators. Where magnetism and topology meet, we find many intriguing phenomena including emergent "relativistic" particles and multipolar degrees of freedom. The novel physics also opens up a promising direction in spintronics and other potential practical applications. In this conference, we explored experimental and theoretical studies on subjects ranging from fundamental issues in correlated topological phases to their cutting-edge applications to spintronics. We invited 19 active researchers who are top-runners of the field around the world, and they presented their latest research results along with active discussions. On top, 11 members from ISSP, especially from Quantum Materials Group, presented their latest research, in order to enhance the collaboration between ISSP and other institutes.

The workshop was a great success. The venue was completely packed for all three days of the workshop by altogether 185 attendees. As planned, the latest results of both experiments and theories are delivered, covering a wide variety of materials such as the heterostructure of topological insulators, frustrated magnets, Weyl antiferromagnets, Kitaev spin liquids, and organic magnets. It should be noted that despite being a transdisciplinary workshop, its Q&A session was very active.

We had 74 poster presentations, 34 of them are from ISSP, and the rest are from all over Japan, including Kyoto University, and Tohoku University. Many people were staying in front of each poster and discussing with each other actively. In addition, the speakers of invited talks participated in poster sessions gave helpful comments to the students and postdocs. We believe this becomes a valuable experience for young researchers. For poster awards, five students were nominated after very competitive selections.

As aforementioned, this workshop has been a great success. We hope that groundbreaking discoveries and inventions will be made soon based on the collaboration initiated from the workshop. Lastly, we greatly appreciate everyone's generous support, including the organizers, judges, directors, secretaries, and student part-timers. Without any of the members, this could not have been accomplished.



Computational Materials Science —Now and the Future—

April 2-3, 2018

T. Hoshi, K. Yasuoka, N. Hatano, T. Ozaki, O. Sugino, H. Noguchi, S. Kasamatsu, Y. Noguchi, Y. Higuchi, S. Morita, H. Watanabe, and N. Kawashima

This annual workshop is a joint activity between the supercomputer center (SSC/MDCL) and the center of computational materials science (CCMS), organized for the research community of the computational condensed matter physics. The objective is for the participants to exchange the information on the recent progress on the computational condensed matter research as well as the technical aspects of the high-performance computation. Every year we invite a few speakers on the topics of general interest. This year's workshop included two such special talks: one by Motoko Kotani (Tohoku U.) who talked about application of discrete geometry to material design by and the other by Teruyasu Mizoguchi (IIS, U. Tokyo) who talked about usage of artificial intelligence for analyzing crystalline interfaces. In addition to these two special invited talks, there were 14 invited oral talks and 32 poster presentations. The results of Software development/improvement project were also reported, where the target programs for FY2017 were DCORE, proposed by Hiroshi SHINAOKA (Saitama U.), and HPhi, proposed by Yohei YAMAJI (U. Tokyo).



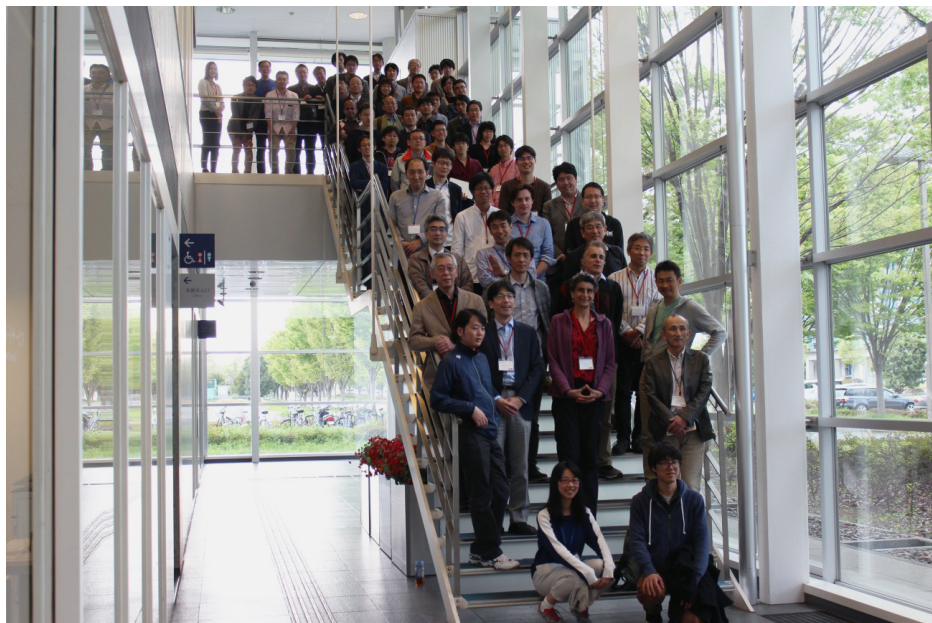
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Novel Phenomena in Quantum Materials driven by Multipoles and Topology

April 9-10, 2018

S. Nakatsuji, M. Oshikawa, and H. Harima

In recent years, the study of quantum materials, in particular of strongly correlated electron systems, have been enriched by the introduction of new physics based on multipoles and topology. The international workshop was planned to bring together scientists exploring the novel phenomena in new materials, and novel functionality by using spintronics and photonics, to share the latest knowledge and to fertilize new research directions. During the two days of workshop, a total of 162 people (92 on the first day and 70 on the second day) participated in the workshop, and 22 of oral and 42 of poster presentations were given by foreign and Japanese scientists. According to the questionnaires the participants filled out, the poster session was particularly well received and yielded fruitful discussions. Although it was an overcrowded schedule of 2 days, discussions were lively held everywhere even during the break time. Our workshop offered great opportunity where all the participants could share information and exchange views on the latest research results related to multipoles and topology.



Frontier Research on Glass Transition and Related Fields

May 10-12, 2018

O. Yamamuro, H. Tanaka, T. Kanaya, K. Miyazaki, H. Hayakawa, K. Fukao, R. Nozaki, J. Habasaki, and N. Shinyashiki

This is the largest domestic workshop on the glass transition which has been held every 2 – 4 years since 2002. The glass transition is a mysterious phenomenon that a liquid is solidified without any structural change and its mechanism has not been clarified yet. In the physical properties of glasses, there are also many unsolved problems (e.g., boson peaks) originating from its non-periodic and disordered structure. Other than the works on the glass itself, there are many interesting phenomena related to the glass transition such as spin glass transition, jamming transition of granular materials, dynamical transition in proteins, etc. It is meaningful to assemble both experimental and theoretical researchers of the areas mentioned above to exchange current information and make discussion for future researches. We organized 43 oral and 45 poster presentations.

The topics of the workshop were (1) glass and supercooled liquid, (2) granular matter, jamming, rheology, (3) water and network glass, (4) biological and electrical glasses, (5) polymer and soft matter, (6) liquid-liquid transition and polyamorphism, (7) ionic conductor and ionic liquid. We had 110, 120 and 100 attendees for the first, second and third days, respectively, including many young researchers and people from outside of ISSP. There was very active and fruitful discussion throughout the workshop.



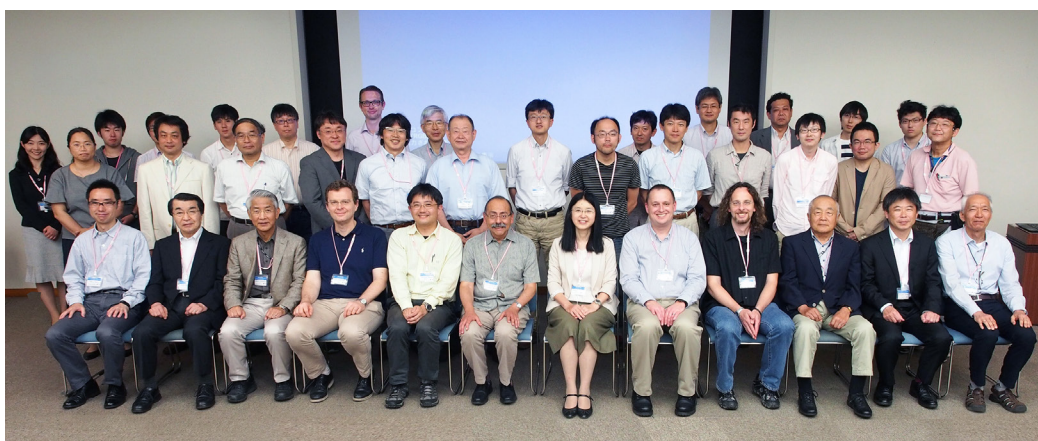
Present and Future of Neutron Scattering Research on Condensed Matter Physics ~Future Perspective of US-Japan Cooperative Program on Neutron Scattering~

June 4-5, 2018

T. Masuda, M. Shibayama, H. Fukazawa, and Taku J Sato

Neutron Science Laboratory the University of Tokyo cooperates joint research program using triple-axis spectrometers (TAS) in JRR-3, high-resolution chopper (HRC) spectrometer in J-PARC, and cold neutron triple-axis (CTAX) spectrometer in HFIR in Oak Ridge National Laboratory. Among them CTAX has been operated under the program based on the agreement between the governments of US and Japan on cooperation research and development in science and technology in 1980, and the spectrometer has been crucial for TAS users in Japan particularly after the long shutdown of JRR-3. In addition, state-of-art inelastic spectrometers including HRC has been producing outstanding results, and the complimentary use with TAS is now popular. Furthermore in 2023 the upgrade of CTAX in large scale, the MANTA project, is planned, and the US-Japan cooperative program is getting more important. In this workshop researchers in the field of neutron scattering in US and Japan discussed the present and future of neutron scattering research on condensed matter physics. The present statuses of CTAX

and MANTA project were reviewed by US researcher, and the future of US-Japan cooperative program was discussed. Furthermore, future of spectrometers in JRR-3 was also discussed. In total 26 of oral and 9 of poster presentations were made by US and Japanese scientists, and the participants had fruitful discussions.



New Trends in Quantum Information and Condensed Matter Physics

July 31–August 3, 2018

M. Oshikawa, T. Sasaki, T. Tomita, Y. Nakata, and M. Negoro

Quantum information science is a rapidly growing research field, aiming not only to explore information processing based on quantum theory but also to understand physics from the viewpoint of information. In the last decade, a number of novel perspectives were introduced from quantum information to many fields of physics, such as condensed matter physics, statistical mechanics, and even high energy physics, revealing that information is indeed the key to understand physics in complex quantum systems. The main goal of this workshop was to further promote these fruitful interactions between quantum information science and quantum physics. To this end, we invited active researchers from various fields, such as cold atoms, strongly correlated systems, black hole science, and quantum information and computation, both theorists and experimentalists. We also had selected talks and poster presentations. Each presentation started with a brief introduction of the topics and ended up with a huge discussion about the recent progress. In total, we had more than 660 participants in four days. This workshop provided a great opportunity to the researchers, who are willing to explore new frontiers of physics from the viewpoint of information, for future interdisciplinary collaborations.



New Development of Science in Strongly Spin-Orbit Coupled Conductors

November 12–13, 2018

M. Tokunaga, Z. Hiroi, I. Matsuda, and Y. Fuseya

Control of physical properties via spin degrees of freedom is a fundamental subject common to various fields of material science. Strong spin-orbit interaction can make this control dramatic if the effect is properly incorporated. This workshop was held to share various on-going subjects in strongly spin-orbit coupled conductors developing independently in each research field. To this end, leading researchers from various fields got together and presented the latest researches in each field.

The workshop was started by theoretical introduction of fundamentals related to the spin-orbit coupling/interaction, and followed by bulk properties of elemental bismuth and the related materials in extreme conditions. In the following session of surface science, non-trivial band topology of pure bismuth was proposed to explain the observed surface states. Further, current status of the studies on spin-Hall and thermoelectric effects in bismuth were introduced in the spintronics and nano-materials session. In addition to the phenomena found in these p -electron systems, effects of strong spin-orbit interaction in d and f electron systems are also discussed. At the end of each session, there was a lively exchange of ideas by researchers in different area at the time of discussion.



Upshift in the Soft X-ray Science of Synchrotron Radiation

November 30-December 1, 2018

I. Matsuda, T. Arima, Y. Harada, H. Wadati, T. Kondo, and S. Shin

The conference was organized on November 30 and December 1 to promote scientific and technological innovations of soft X-ray synchrotron radiation, motivated by the announcement on the next-generation facility by the Minister of Education, Culture, Sports, Science and Technology on July 3, 2018. It has successfully brought together more than 200 participants, including the presidents and the outstanding researchers of synchrotron radiation institutes and societies from all over Japan. The presentations at the ISSP lecture room were broadcast live to a conference room in SPring-8 through the internet. On the first day, the program focused on science and technology to be evolved at the new facility, while, on the second day, it featured experimental methods and information technologies to be developed toward researches with the light source.

With the next-generation soft X-ray synchrotron radiation, measurements are expected to be made with multi-dimensional data acquisitions or with ultra-high resolutions that have never been possible at the existing facilities. The attendance interdisciplinarily argued research topics to respond to needs in academic and industrial fields today. There was also vigorous discussion on the cutting-edge informatics to be applied in the data analysis. We were confident that the workshop was very timely and that all the arguments would become seeds of the novel science and technology.

The conference was hosted by the Institute for Solid State Physics (the University of Tokyo), Synchrotron Radiation Research Organization (the University of Tokyo), Tohoku University, and User Community of VUV·SX high-brilliant light sources.



Liquid-Crystal-like Electronic States Generated by Quantum Many-Body Effects

December 27-28, 2018

T. Shibauchi, T. Kimura, T. Hanaguri, K. Kobayashi, K. Ohgushi, H. Kontani, and K. Okazaki

Recently, in the normal states of iron-based and cuprate superconductors, electronic states with spontaneous rotational symmetry breaking have been observed, which are called “electronic nematic” states. It has been a central issue to understand the relationship between high-temperature superconductivity and such electronic states that bear some analogy with liquid crystals. It has also been an important issue in insulating quantum spin systems that “spin liquid crystals” with broken symmetries, which differ from conventional magnetic orders (spin solids) and quantum spin liquids, may be realized. Those include spin nematic and chiral spin liquid states. These liquid-crystalline electronic states in metals and insulators are non-classical phenomena driven by quantum fluctuations and quantum many-body effects, which may have underlying principles that are important to study. This workshop aimed to provide a unique platform for developing new exchanges between different communities of superconductivity, strange metals and magnetic insulators. In two days, 25 talks and 27 poster presentations were given with lively discussions.



