

# Conferences and Workshops

## *International Conferences and Workshops*

### **New Horizon of Strongly Correlated Physics (NHSCP2014)**

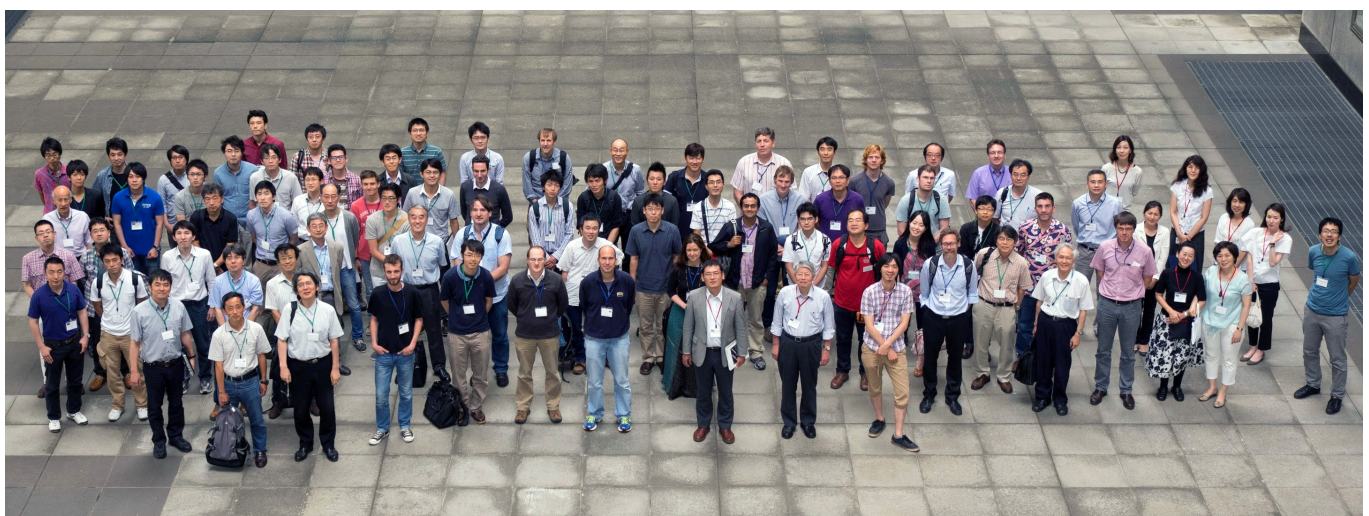
June 16 - July 4, 2014

H. Tsunetsugu, K. Ueda, H. Kusunose, A. Koga, and J. Otsuki

Since 2006, the ISSP has organized an annual series of three-week workshops, with the only exception in 2011 due to the aftermath of the Tohoku earthquake. The last two in the series are “MATERIAL Simulation in Petaflops eta” (MASP2012) and “Emergent Quantum Phases in Condensed Matter – from topological to first-principles approaches” (EQPCM2013). In 2014, the ISSP organized the eighth workshop, “New Horizon of Strongly Correlated Physics” (NHSCP2014), held for three weeks starting from mid-June. Recent developments in theoretical and numerical studies on strongly correlated systems were discussed, and a special focus was placed on the strong correlation effects on dynamics and non-equilibrium phenomena. The main topics intensively discussed include the non-equilibrium Mott transition and optical response there, spin liquids, frustrated systems, topological insulators in strongly correlated electron systems, multipolar order in heavy fermion systems, multiple-component superfluidity in optical lattices. Dynamical mean field theory is the highlight in the workshop. Its many new progresses and developments were presented, and the dual-fermion and the dual-boson approaches aroused intense interest. The program and presentation materials are available on the web at the URL <http://www.issp.u-tokyo.ac.jp/public/nhscp2014/>.

Following the tradition of the series, the workshop contained the intensive three-day symposium during Jun. 25–27, and 33 oral and 17 poster presentations were made there. The remaining part was arranged into a more relaxing style providing a long discussion time, and 21 oral presentations were made. This style of workshop attracted many people; the cumulative number of participants during the three weeks summed up to just 600, and 272 of them attended the symposium part.

The NHSCP2014 workshop was organized by the ISSP and it was also supported by Computational Materials Science Initiative (CMSI) and Elements Strategy Initiative Center for Magnetic Materials (ESICMM). The workshop chairman was Hirokazu Tsunetsugu (ISSP) and the other organizers were Kazuo Ueda (ISSP), Hiroaki Kusunose (Ehime Univ.), Akihisa Koga (Tokyo Tech.), and Junya Otsuki (Tohoku Univ.). The organizers acknowledge a significant contribution from the overseas scientific advisor, Philipp Werner of University of Fribourg.





# Joint Symposium of Polymer Networks and Research Group on Polymer Gels (PN&G2014)

November 10 - 14, 2014  
M. Shibayama

The joint symposium of the 22nd Polymer Networks Group Meeting (PNG) and the 10th Gel Symposium (PN&G2014) was held at Ito International Research Center in Hongo Campus, the University of Tokyo. The PNG Meetings, started in 1975 in Strasburg, France, were held in Europe every other year, and is focusing on the physics of polymer networks and the theory of gelation, the structure and properties of polymer networks. On the other hand, Polymer Gel Symposium, an international symposium on polymer gels launched in 1989, is organized by Research Group on Polymer Gels, the Society of Polymer Science, Japan. It has also been held every other year, but exclusively in Japan. This was the first joint symposium on polymer networks and gels with the theme of “Cutting Edge of Chemistry, Physics, and Engineering in Polymer Networks”. The symposium covered all fields of polymer gels and networks and provided a platform for scientific exchange in all areas relevant to theory and simulation, fabrication, structure, properties, and industrial/medical applications of gels.

There were 281 active participants from 23 countries. The oral sessions included 8 plenary lectures, 18 keynote lectures, 5 invited lectures, 56 contributed papers, and 7 Young Investigator Award nominee lectures. The symposium started with a mixer on Nov. 10, where a large number of participants from abroad got together. The scientific session began on Nov. 11 and ended with the concluding remark in the evening of Nov. 14, followed by Symposium Banquet with a large number of participants. Poster sessions were scheduled in the evening session from 19:00 – 20:30 on Nov. 11 and 12, and 134 posters were displayed in the two sessions. In addition to high-quality posters, snack service kept the audience to stay in the session until the last minute. 7 young investigators were awarded to the first PNG Young Investigator Awards sponsored by Sumitomo Bakelite Co. and by German and UK companies. In addition, 10 poster awards sponsored by Soft Matter, Royal Society of Chemistry, UK, and Research Group on Polymer Gels, Japan, were given to young scientists including graduate students and postdoctoral fellows. The next PNG will be held during June 19 – 23, 2016, in Stockholm, Sweden.

<http://www.issp.u-tokyo.ac.jp/public/PNandG2014/>



Young Investigator Awardees, PNG



Banquet



## ISSP–MPIPKS Joint Workshop: Dynamics of Strongly Correlated Systems” (DSCS2015)

March 30 - 31, 2015  
H. Tsunetsugu and R. Moessner

The ISSP conducts academic exchange programs with several foreign institutions, and one of the partners is Max Planck Institute for the Physics of Complex System (MPI–PKS) in Dresden, Germany. As a part of this exchange program, the ISSP and MPI–PKS recently started organizing joint workshops, and the first one took place at MPI–PKS in April of 2012. In this March 30–31, the ISSP hosted the second joint workshop, “Dynamics of Strongly Correlated Systems” (DSCS2015), and it was cochaired by Hirokazu Tsunetsugu (ISSP) and Roderich Moessner (MPI-PKS).

The DSCS2015 workshop aimed at overview and discussion on recent developments in theories and experiments on strongly correlated systems with special focus on their dynamical properties, non-equilibrium and transport phenomena, and related topics. Main subjects discussed include the following topics: electric and thermal conductivities, cross response between electric, magnetic, and thermal properties, topological quantum phases in strongly correlated electron systems, and effects of strong correlations on topologically protected surface states. Responses near metal-insulator transition or charge order were another focused topic as well as exotic properties of frustrated magnets/metals and unconventional superconductors. Another important topic was an emerging one and that was thermalization/non-thermalization of strongly correlated systems.

During the two-day workshop, the cumulative number of participants was 128, and there were 15 oral presentations, of which 13 were invited, and 19 poster presentations. The papers presented have stimulated participants and they are expected to yield various further progresses in the future. The program and the abstract booklet are available on the web at the URL <http://tsune.issp.u-tokyo.ac.jp/dscs/index.html>



## Novel Quantum Phenomena in Supermatter

April 17 - 19, 2014

K. Shirahama, M. Tsubota, M. Oshikawa, and Y. Okuda

Emergent quantum phenomena in matters often lead to universal concepts in science. As a prime example, superfluidity/superconductivity observed at very low temperatures gave a motivation to formulate spontaneous symmetry breaking in field theory and high-energy physics. In order to find a seed of universal concept, it is desirable to control the degrees of freedom and structure of the matter so that the system can be tuned to exhibit a particular phenomenon in a genuine way. This is realized in various systems which we will call “super matters” with multiple layers of structure. The term was conceived in analogy to superlattice, which is made by stacking different crystals. Examples of super matters include quantum vortices in superfluids/superconductors, ultracold atoms and liquid Helium in periodic potentials, quantum spin liquid with exotic elementary excitations, collective excitations in superfluid Helium 3, and exciton-polariton condensates with highly tunable parameters. We hope that the development and investigation of various supermatter systems will contribute to elucidation of fundamental problems in physics and to construction of novel universal concepts.

This workshop was organized with the purpose of sharing the common perspective of supermatter among scientists from various backgrounds, and of discussing future directions. Although the workshop was held at the beginning of the Japanese academic year, there were 244 cumulative participants over 3 days, attending 40 oral and 27 poster presentations and lively discussions. It was indeed a very useful meeting to exchange ideas based on studies of many different systems which had been pursued independently, and to seek new directions.

Details on the workshop can be found in the web page (in Japanese):

URL <http://www.issp.u-tokyo.ac.jp/public/SuperMatter/>



## New Horizon of Strongly Correlated Physics (NHSCP2014)

June 25 - 27, 2014

H. Tsunetsugu, K. Ueda, H. Kusunose, A. Koga, J. Otsuki, and Z. Hiroi

This ISSP workshop was held as the symposium part of the international workshop of the same title. See the section of “International Conferences and Workshops”.



## Toward a Paradigm Shift of Synchrotron Radiation Based Materials Science in the VUV-SX Region

September 20 - 21, 2014

Y. Harada, A. Fujimori, S. Shin, F. Komori, and I. Matsuda

In order to encourage a motivation and discussions that demand an internationally competitive vacuum ultra-violet-soft X-ray (VUV-SX) light source in Japan in addition to the present synchrotron light sources, it is now necessary to accelerate mutual communications not only within the present VUV-SX community but also with broad scientific community. This workshop was held aiming to boost a paradigm shift of synchrotron radiation based materials science and further of all the scientific community in Japan by broad-ranging discussions beyond the concept of community such as ultra-violet, soft X-ray, hard X-ray and even inside/outside synchrotron radiation. The program was categorized into four sessions by “catalyst/battery”, “soft matter/biomaterial”, “solid and surface physics” and “materials science” and representative or energetic and pioneering young researchers in each field were selected as speakers of review-talks.

In all sessions there were a lot of questions and comments, regarding such as new scientific directions by a combination of different synchrotron techniques, actual scientific requests for the energy/spatial resolution that much exceed the ability of the present synchrotron techniques, possible collaborative synchrotron and neutron studies and so on. The workshop dealt with issues mostly aiming at real applications, thus it was unique among workshops held in ISSP and will contribute to establish a new scientific trends in ISSP.



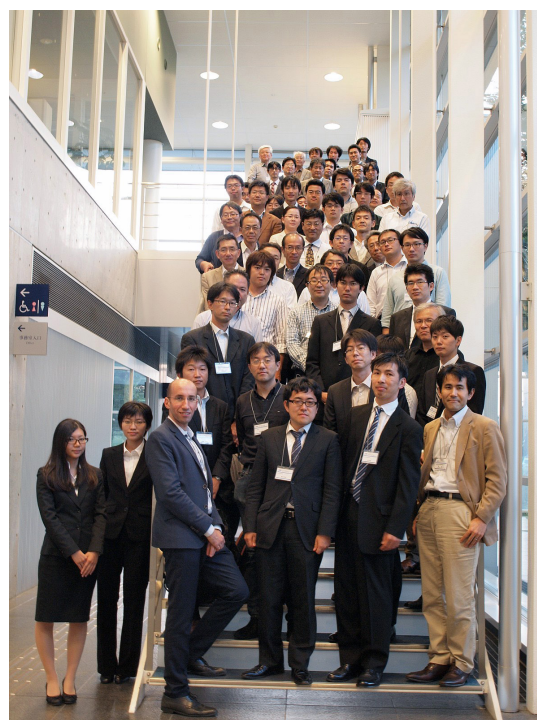
## ISSP Workshop: Physical Chemistry Revealed by Advanced Operando Observations

September 29 - 30, 2014.

I. Matsuda, J. Yoshinobu, Y. Harada, S. Yamamoto, Y. Takagi, and M. Nagasaka

Today there is strong demand in our society towards developing novel catalysts and devices that will solve energy and environmental problems. In recent years the importance of the spectroscopic/microscopic characterization of materials during operation with confirming their operation at the same time starts to be realized. For example, chemical reactions on a catalyst surface involve a variety of dynamic processes such as adsorption, diffusion, desorption of molecules. To gain the fundamental understanding on a reaction mechanism, the heterogeneous catalysts under real reaction conditions have to be studied. This approach is called “*Operando* observation”, which becomes a key topic in catalysis and device researches. Very recently, “*Operando* observation” in X-ray region becomes possible by the development of high-brilliant synchrotron light sources and novel instruments.

This workshop thus aimed to discuss the latest results both from experimental and theoretical studies on the catalysts and devices using “*Operando* observation”, and to create new human network among the researchers’ community and promote the scientific collaborations. The workshop covered a broad range of related topics including X-ray spectroscopies, electron microscopies, vibrational spectroscopies as well as theoretical studies. The workshop welcomed 102 participants, notably 30% of which are from private companies. The program of the workshop consisted of 1 invited lecture, 13 invited oral presentations and 16 poster presentations.



## Recent Advances in Physics of Strongly Correlated Electrons in Skutterudite and Related Compounds

October 10 - 12, 2014

C. Sekine, T. Sakakibara, H. Harima, Y. Aoki, R. Shiina, and K. Iwasa

Filled skutterudite compounds, in particular Pr- and Sm-based ones having more than two  $4f$  electrons, exhibit a variety of many-body quantum phenomena. Extensive studies were done on these systems during the MEXT project, Grant-in-Aid for Scientific Research on Priority Area “Evolution of New Quantum Phenomena Realized in the Filled Skutterudite Structure” (2003-2007), and the basic physical picture of those phenomena was partly clarified. Seven years have past after the end of the project, and there has been substantial progress in the research on filled skutterudites and the related systems having a similar caged structure. This workshop was aimed to further advance the physics of strongly correlated systems realized in those caged systems, and covered a broad range of topics including pyrochlores, clathrates, and  $RT_2X_{20}$ . The presentations included 4 review talks, 13 invited talks and 22 poster presentations. Recent advances and some remaining issues in this field were discussed intensively.



## Supercomputer Users Meeting

November 13 - 14, 2014

T. Oguchi, S. Yunoki, R. Yamamoto, S. Tsuneyuki, S. Todo, H. Noguchi, O. Sugino, H. Akai, T. Ozaki, H. Watanabe, H. Kasamatsu, Y. Noguchi, S. Morita, I. Matsuda, S. Harada, and N. Kawashima

This is the meeting for the ISSP supercomputer general use held annually to exchange information on the latest developments in condensed matter physics achieved by the use of ISSP supercomputer. This year's meeting was held also for the CCMS annual activity report. The selection of speakers is based on suggestions made by three unaffiliated scientists appointed as the program committee members. Since SY2014 is the last year of the current supercomputer system that started operation in 2010, the meeting was a good opportunity for surveying what have been achieved by the current system, and indeed an active discussion was held among the audience, of which the cumulative total number was 154. Having made the keyword of this year's meeting “Industrial Applications of Computational Sciences”, we had speakers who have close contact with researchers in industry and their industry partners, such as Taisuke Ozaki (ISSP) and Hideaki Sawada (Nippon Steel & Sumitomo Metal). Yoshitaka Tateyama (NIMS) gave a presentation on his recent work of the first-principles calculation concerning solid battery. We also invited three speakers who wrote invited articles in the annual report of ISSP supercomputer general use: Shiro Sakai (RIKEN), Takeo Hoshi (Tottori) and Hayato Shiba (ISSP). Also notable was the presentation on software developments and their public release in the field of condensed matter physics.





# ISSP Series Workshop on Synergetic Science for Functional Material Systems: (1) Optical Functions

December 4 - 5, 2014

H. Akiyama, H. Mori, J. Yoshinobu, F. Komori, M. Shibayama, T. Suemoto, O. Yamamuro,  
O. Sugino, H. Noguchi, Y. Harada, I. Matsuda, and M. Lippmaa

This workshop focusing on optical functions is the first one among series workshops on synergetic science for functional material systems, which were proposed and organized by the 12 members of ISSP working group for a future plan on a new research center of interdisciplinary area. We collected presentations consisting of 16 invited talks and 19 contributed posters. The topics of the workshop covered functional optical properties of various material systems, functional optical imaging, and bio-medical imaging. Protein was one of the most frequently discussed material systems, which enable ion pumping, photo-synthesis, photo-sensing, and bio-luminescence in biological systems. Novel bio-medical imaging was also hot topic in the workshop. Though they had been exotic subjects in ISSP seminars, we sincerely realized that those are important subjects that ISSP must watch and challenge. We had 76 and 57 attendances for the first and the second days, respectively, including young researchers and students from other universities.



# ISSP Workshop: Status of SPring-8 BL07LSU and Prospects for the Next Generation Synchrotron Light Sources

March 5, 2015

H. Wadati, S. Shin, F. Komori, I. Matsuda, and Y. Harada

Synchrotron radiation laboratory has a Harima branch to maintain and develop a high-brilliance soft X-ray beamline BL07LSU at SPring-8. There we are performing time-resolved, spatial-resolved and energy-resolved soft X-ray spectroscopy to study electronic states and their dynamics of new materials. In this workshop, recent research activities at our beamline were reported and our future prospects toward the next generation synchrotron light sources were discussed. The speakers talked about their recent results from each end station (time-resolved spectroscopy, 3D nano-ESCA, emission spectroscopy, and so on). There were two invited talks; one is about synthesizing new materials and the advantage of using synchrotron x-rays for this synthesis process, and the other is about the upgrade plan of the light source to SPring-8 II. There were a lot of discussions for each talk, and we successfully started to obtain a clear vision about how we can utilize the next generation synchrotron light sources for the condensed-matter research. We also encouraged the young generation in this research field by awarding the best poster prizes to two graduate students.



# ISSP Workshop: Topological Aspects in Correlated Electron Systems

March 26, 2015

S. Nakatsuji, M. Oshikawa, T. Sakakibara, and M. Takigawa

This workshop was intended to deepen our understanding on novel phenomena that have been seen in many correlated electrons and its possible relation to topology of electronic structure and spin texture. Experts from the field provided us both pedagogical and advanced talks on topical subjects covering iridates, heavy fermions, Bismuth, Axion and Weyl anomalies in metals. Another purpose of the workshop was to enhance the collaborative research activities among participants. For the latter perspective, the workshop was supported by both the ISSP workshop series, and by our JSPS project for Strategic International Networks Project on Topological Phenomena in Novel Quantum Materials.

In spite of a short announcement, a large number of on/off-campus researchers reaching 75 attended this workshop. The workshop consisted of two parts. The morning part was a pedagogical lecture for non-experts on “Novel correlated topological phases in correlated materials.” by Prof. Leon Balents (UCSB), which gave an introduction on the concept of the topology in condensed matter physics and its application to correlated electron systems.



The afternoon part was made by three sessions with a series of talks intended for experts. As the first speaker in the first session, Prof. Luis Balicas (NHMFL, Florida) gave a talk on the discovery of the axial anomaly in the quasi-two-dimensional metal PdCoO<sub>2</sub>. This talk was followed by Prof. Masaki Oshikawa (ISSP), who made a theory talk on the chiral magnetic effect in an insulator. Then, the next session focused on the recent development in understanding of Bismuth. First talk was given by Prof. Yuki Fuseya (UEC, Tokyo) on Spin Hall Effect and Large Anisotropic g-Factor of Bismuth. This was followed by an experimental talk by Dr. Robert Kuechler (MPI-CPfS, Dresden), on the thermodynamic evidence for valley-dependent density of states in bulk bismuth. Finally, in the last session, the topological aspects in strongly correlated electron systems were discussed. In particular, two talks were given focusing on the quantum critical phenomena in the mixed valent system  $\beta$ -YbAlB<sub>4</sub>. Distinct quantum critical behaviors were discussed in the first talk by Dr. Takahiro Tomita (ISSP), which were found to form a strange metal without magnetic criticality. It was pointed out that these quantum critical behaviors are clearly different from the typical non-Fermi liquid behaviors observed in the vicinity of the antiferromagnetic quantum critical point. Finally, Prof. Andriy Nevidomskyy (Rice Univ., Houston) introduced a novel topological viewpoint to understand anomalous properties and superconductivities in the heavy fermion systems such as  $\beta$ -YbAlB<sub>4</sub> and UPt<sub>3</sub>. Throughout this workshop, very active discussions were made and the future direction was addressed to shed further light on the emergent topological phenomena in correlated electron systems.

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