KINKEN WAKATE 2023: International Materials Science School 2023-Advances in Strongly Correlated Electron Systems

Joint workshop: Topology, spin-orbit interactions and superconductivity in strongly correlated quantum materials under extreme conditions

Dai Aoki
IMR, Tohoku University, Oarai, Ibaraki 311-1313

Keywords: spin-orbit coupling, hidden order, UTe2, superconductivity, Fermi surface

The International Materials Science School 2023 (KINKEN WAKATE 2023) took place on October 9, 2023, in Grenoble, France. This event was followed by the international workshop titled "Topology, Spin-Orbit Interactions, and Superconductivity in Strongly Correlated Quantum Materials under Extreme Conditions" from October 10 to October 12, 2023, making it a joint event.

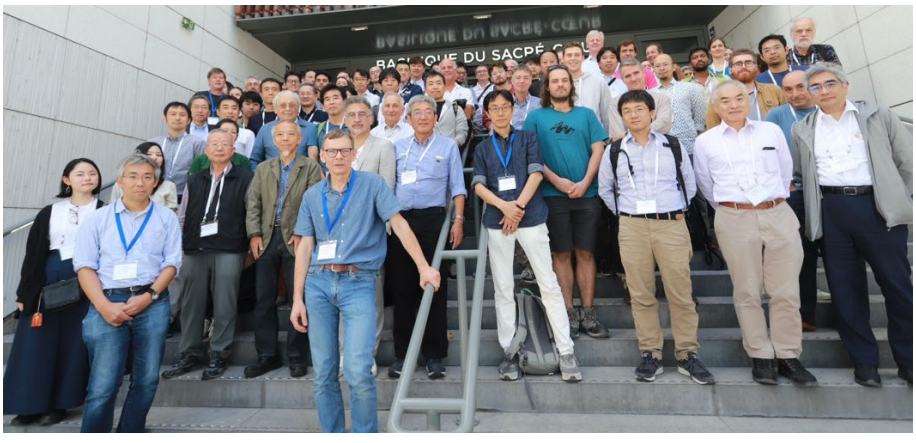
The school and the workshop aimed to discuss and exchange recent progress in the study of strongly correlated quantum materials under extreme conditions such as high fields, high pressure, and low temperatures. These conditions are critical for understanding phenomena like topological effects, spin-orbit interactions, superconductivity, multiple orders, and fermiology.

On the first day, the school was held at the high-field laboratory in Grenoble (LNCMI-G). It featured two tutorial lectures by Prof. Yoichi Yanase and Prof. Rikio Settai. Prof. Yanase discussed topological superconductivity, while Prof. Settai focused on quantum oscillation effects. In addition to the lectures, participants had the opportunity to tour the high-field lab and attend short poster previews.

From the second to the fourth day, the international workshop took place at the Basilique du Sacré-Cœur, located near the Grenoble train station. The workshop included a total of 36 oral presentations and 21 poster presentations. Researchers and students from around the world gathered to share their findings and discuss various topics related to quantum materials.

The workshop provided an excellent platform for the exchange of ideas and the establishment of collaborations. The diverse range of presentations covered cutting-edge research in topological phenomena, the interplay between spin-orbit interactions and superconductivity, and the physical properties under extreme conditions. This event highlighted the importance of multidisciplinary approaches in advancing our understanding of strongly correlated quantum materials.

Overall, the International Materials Science School 2023 and the subsequent workshop were successful in fostering discussions and collaborations among researchers and students, contributing significantly to the field of quantum materials science.



LNCMI-G

Time		9 Oct. (Mon.)
14:00	15:15	Yanase (tutorial)
15:15	16:15	Break & High-Field Lab Tour
16:15	16:45	Short Poster Preview
16:45	18:00	Settai (tutorial)

Basilique du Sacre-Coeur

Time		10 Oct. (Tue.)	Time		11 Oct. (Wed.)	Time		12 Oct. (Thu.)
8:30	8:50	Registration						
8:50	9:00	Opening	8:30	9:00	Behnia	8:30	9:00	Hasselbach
9:00	9:30	Harima	9:00	9:30	Izawa	9:00	9:30	Kambe
9:30	10:00	Onuki	9:30	10:00	Kotegawa	9:30	10:00	Tou
10:00	10:30	Araki	10:00	10:30	Suzuki	10:00	10:30	Julien
10:30	11:00	Break	10:30	11:00	Poster I & Break	10:30	11:00	Poster II & Break
11:00	11:30	de Visser	11:00	11:30	Hassinger	11:00	11:30	Measson
11:30	12:00	Spalek	11:30	12:00	K. Miyake	11:30	12:00	Shishido
12:00	12:30	Suderow	12:00	12:30	Amitsuka	12:00	12:30	Watanabe
12:00	14:00	Lunch	12:00	14:00	Lunch	12:00	14:00	Lunch
14:00	14:30	Bauer	14:00	14:30	Ishida	14:00	14:30	Penc
14:30	15:00	Onimaru	14:30	15:00	Knafo	14:30	14:45	Garbarino
15:00	15:30	Utsumi Boucher	15:00	15:30	A. Miyake	14:45	15:15	Raymond
15:30	16:00	Poster I & Break	15:30	16:00	Poster II & Break	15:15	15:45	Flouquet
16:00	16:30	Ohara	16:00	16:30	Yanagisawa	15:45	16:00	Closing (Harima)
16:30	17:00	Matsuda	16:30	17:00	Kimata			
17:00	17:30	Pourret	17:00	17:30	Fujimoto			
			19:00		Workshop Dinner			

KINKEN WAKATE 2023に参加した学生の会議報告

材料科学若手学校（KINKEN WAKATE 2023）と国際ワークショップ "Workshop on Topology, Spin-Orbit Interactions and Superconductivity in Strongly Correlated Quantum Materials under Extreme Conditions”（H-Physics Workshop）が、2023年10月9日から12日までグルノーブルで開催されました。参加者は合計78名で、37件の口頭発表と22件のポスター発表が行われました。学生の参加者は13名でした。日本から参加した学生のうち、以下の6名については、ICC-IMRと学術変革「アシンメトリ量子」から旅費が補助されました。A4半分程度の英語での会議報告を求めた結果、以下の通り会議報告がありました。

会議期間中には、ILL、LNCMI、ESRF、Institute Neel、CEAなどの大型研究施設やグルノーブルの主要な研究室を訪問した学生もいて、大変刺激を受けたようです。また、フランスの学生との交流や、会議中のポスター発表でのディスカッションも大変有意義だったとのことです。このように、若手が海外で交流する機会を設けることは、将来を担う若手育成という意味で非常に意義深いものです。ICC-IMRからの支援にあらためて感謝いたします。

青木 大

Report on H-Physics workshop

Fusako KON
Hokkaido University

This report documents my participation in “H-Physics workshop” held in Grenoble France, from October 9 to 12. On the first day, I attended the tutorial session. The presentations are given by Prof. Yanase and Prof. Settai. Each provided a comprehensive overview of the historical background and recent results in the field of strongly correlated electron systems from the perspectives of theoretical studies of unconventional superconductivity and experimental studies using dHvA effects, respectively.

From the second day to the final days, many oral presentations are given by researchers from several countries. These presentations covered a wide range of materials, including attractive unconventional superconductors such as UTe_2 and $CeRh_2As_2$, as well as other strongly correlated f-electron and d-electron systems, and even quasicrystal systems. In addition to the oral sessions, we had poster sessions. In the poster sessions, I presented my recent studies on UPt_2Si_2 and discussed with some participants. This allowed me to gain diverse insights into my research.

The participants shared not only their results but also some episodes about their research lives. These episodes showed how the international collaborations and the cooperations between theoretical and experimental researchers can develop new research possibilities. In fact, I got the opportunity to establish international personal connections through the workshop, and the interactions with female researchers actively working abroad were particularly inspiring and encouraging for me.

I am grateful for these experiences and will apply them to my future research activities.

Taiki Miyamoto
Osaka University

I participated in the workshop in Grenoble and went to laboratory tour in CEA, ILL, ESRF and CNRF. I will report about these activities.

In the workshop, I presented our research in a poster section. Our research about a magnetic toroidal system is not well-known foreign countries, and actually, many researchers didn't know the magnetic toroidal multipole and the concept of cluster multipole. Therefore, I had to explain not only brief background but also more basic and detail background. For me, it was very difficult to explain that in English. This opportunity is very valuable for me because I have never participated in international conference.

In laboratory tour, I went to CEA, ILL, ESRF, and CNRF. I haven't been to large laboratory, so I was surprised that all buildings are optimized for experiments. For example, in CEA, all pumps are placed in rooms dedicated to pumps, and vibrations from pumps to probes are completely eliminated. I was most interested in scanning SQUID in Prof. Klaus Hasselbach's laboratory. His SQUID tip was nano-SQUID, and the tip also has a needle for AFM. To make nano-SQUID, high sensitivity photolithography is needed and the laboratory, of course, has it. By having AFM with SQUID tip, the scan becomes more accurate. One of the things which realize such a scan is the building. The building eliminates a vibration from the ground. In our laboratory, we couldn't do this experiment due to vibration.

In conclusion, this experience is very valuable for my future. I will be willing to participating in like this opportunity in the future. Thank you very much for your great support.

Report of H-Physics workshop in 10/9~10/12 @Grenoble, France

Ryohei Oishi, Hiroshima University

Supported by ICC-IMR, I visited Grenoble, France to attend a H-Physics workshop in 10/9~10/12. Many kinds of research of condensed matter, for example Fermi Surface, U-based compounds, and multipoles etc, were given lectures in the workshop. My purpose of visit is to discuss our works of RPt$_6$Al$_3$ and to find Postdoc jobs after finishing a PhD course.

For the Dr. E. Bauer's talk about "Yb compounds: a rich playground for unconventional ground states", he discussed about the frustrated Kondo lattice compounds. I could get the opportunity to discuss our result of honeycomb Kondo lattice compound CePt$_6$Al$_3$ with him, which gave us one idea to distinguish the role of Kondo effect and frustration. In my poster presentation for 30 + 30 min, I discussed about the geometrical condition induces DM interaction in RPt$_6$Al$_3$ with centrosymmetric structure. Finally, every researcher agreed with our idea.

We visited CEA, ILL, ESRF, and CNRS before workshop. Because I would like to find a Postdoc job of synthesizing single crystals by a variety of methods, I was so excited to see the equipment of crystal growth and talk with Dr. Gerard in CEA. For synthesizing crystals by Czochralski method, Dr. Gerard designed a holder of seed crystal, which can arrange the position by himself. These original technics surprised me, and I plan to design myself in Japan.

Report of H-Physics workshop @ Grenoble, France

Kenta Sudo (IMR, Tohoku Univ., Japan)

I attended the tutorial session "Kinken-Wakate 2023" on "Topology, spin-orbit interactions and superconductivity in strongly correlated quantum materials under extreme conditions" in Grenoble, France, held on 2023/10/09. Here, I performed short poster preview that is summary of my poster will be talked in main session.

Main session of H-physics work shop was held on 10/10-10/12. In the main session, I performed poster presentation “Spontaneous nonreciprocal resistance in a zig-zag antiferromagnet NdRu2Al10”. Then I had discussions with the participants and deepened my consideration of my research results. Furthermore, I attended all lecture and got new idea for my next research.

Finally, I visited the Neel Institute in Grenoble, France, and had discussions with Klaus Hasselbach and Arnaud Badel. As a result, I got new ideas to develop my own research topic. In addition, I succeeded making global research network.

The report of H-physics workshop

Hiroto Suzuki, Hiroshima University

I went to Grenoble to participate in the H-physics workshop and to visit some laboratories from October 3 to 16. The visit allowed us to go to CEA, ILL, ESRF, and CNRS. I was impressed by the research-first approach taken throughout the building design. Specifically, a room existed just for the installation of refrigeration pumps to avoid noise and vibration. In addition, I was surprised that there is a technician just for the synthesizing crystal. This visit to an overseas laboratory was the first time for me. These laboratories have many different things with Japanese laboratories. This experience broadened my mind.

At the Workshop, I gave a poster presentation on my discovery of a new material titled "Anisotropic antiferromagnetic order in orthorhombic $EuPdAl_6$". Not only Japanese but also French students listened to and were interested in my presentation. I could discuss it with them. After the tutorial workshop, Co-chairs arranged for us to have the opportunity to meet with French students. They took us to a bar in Grenoble and I was able to deepen my friendship with them. Throughout the workshop and visiting laboratories, I realized my lack of English skills. In the future, I would like to make more efforts in both research and English and I can make better presentations at international conferences.

Report of H-Physics Workshop

	Name	Hiroki Matsumura

Conference name	Topology, spin-orbit interactions and superconductivity in strongly correlated quantum materials under extreme conditions
Place	Grenoble, France
Date	2023/10/9 – 2023/10/12

With the support of ICC-IMR, I participated in the H-Physics Workshop held in Grenoble, France.

This is an international workshop to discuss the results of research on strongly correlated electron systems under extreme conditions. The meeting was a very useful opportunity to learn about cutting-edge research results, both theoretical and experimental studies.

I gave a poster presentation on the recent progress of NMR measurements on the spin-triplet superconductor UTe_2, and was able to discuss the results with many researchers.

Finally, I would like to acknowledge ICC-IMR for financially supporting me and Prof. Aoki and other co-chairs for providing me with this valuable opportunity.