

William SACKS (Sorbonne University - Solid State Physics - Theoretical approaches) Visiting professor at the Department of Physics - Okayama University -



Professor William Sacks

I-Ma-C* Professor --- (5 months starting April, 2020)

- Interview conducted in Okayama by Pr. CHENEVIER ** in June - 2020 -

* I-Ma-C stands for International Master Course (Okayama)

** Research Director at CNRS and currently on secondment since April 2014 at Okayama University where he is responsible for the international development of Research activities.

NB: the stay took place during the Covid-19 pandemic period

My interest in Japan

I come from a family that is very open to international concerns, for reasons mainly related to my father's profession: he was a public-health medical doctor who worked for UNICEF and WHO (World Health Organization). This has influenced me to travel to many countries and to spend the majority of my childhood in Geneva, Switzerland. After graduating from the International School of Geneva, I returned to the US and graduated from Tufts University and Georgetown University. After graduation in 1985, I took a full-time research and teaching position in France (presently Sorbonne University).

I have always been fascinated by Japan which excels in high-technologies, top-level research which coexists harmoniously with a strong traditional culture in writing, the arts and many crafts. As a youngster I had a fascination for origami, calligraphy and judo. Naturally, I wished to come and experience Japan first-hand!

Scientific Background

Research

For more than 25 years, my research interests have centered on novel materials and their exotic electronic structures. Our major contributions have been on low-dimensional materials (charge density wave state) and superconductivity (high T_c cuprates, multiband superconductors).

Theoretician by training, I have always worked very close with the experiments. Indeed, I actively participated with D. Roditchev and T. Cren (INSP, Paris) on the development of low temperature Scanning Tunneling Spectroscopy, with atomic resolution, and the realization of the first Josephson Microscopy, capable of detecting the superconducting condensate in real space.

At the IMPMC laboratory, A. Mauger, Y. Noat and I are currently working on the theory of high-T_c superconductivity, which is to date an unsolved and difficult problem. In 2014 we proposed a new mechanism based on the Bose-Einstein condensation of interacting pairs. A 'pairon' is a new quantum boson consisting of two bound holes in an antiferromagnetic background. Japan is highly active in superconductivity: both theory and experiment, and this is a very strong motivation to visit and collaborate with Japanese scientists.

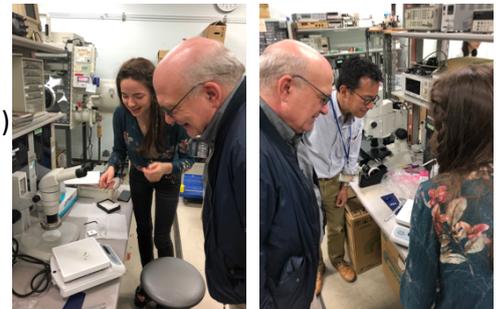
My teaching subjects:

Quantum states of matter, superconductivity (Graduate level)

General physics : mechanics, thermodynamics, relativity (Bachelors level)

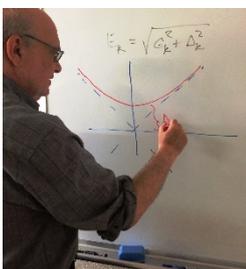
Mathematics using Mathematica™ (Bachelors level)

Pictures on the right: In June 2019, at Okayama University, Professor Sacks is elaborating new models by discussing with Ariane Dupond, a Sorbonne University - ERASMUS - student at Okayama University and professor M. Nohara, Ariane's supervisor.



Motivations and preliminary contacts with Okayama University

My first visit to Japan was naturally in the context of a major conference on High-T_c superconductivity, held in Kanazawa in 1995. I was invited by Pr. M. Tsukada, from the University of Tokyo, to present our very first results on the cuprate superconductors. Because of my interest in Japan and my strong wish to collaborate with Japanese scientists, I renewed contacts with a research groups of international acclaim. This included Pr. A. Fujimori (University of Tokyo), Pr. Nobuaki Miyakawa (Tokyo University of Science), Pr. M. Oda (Hokkaido University) and Dr. H. Eisaki (AIST, Tsukuba), where I gave seminars on our work in Paris and learned much about the ongoing results in Japan. Later in 2015 and 2016, I was invited Pr. Miyakawa to give lectures to Masters students on remarkable materials and superconductivity. This was a most enriching experience, indeed.



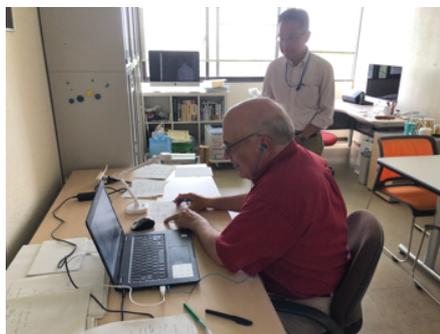
At the same time, having finished my directorship of the Masters program in material science in Paris, I became involved in International Relations with Japan. At this occasion, together with Pr. H. Maruyama, we co-sponsored an innovative bi-lateral agreement with Hiroshima University. It was at this occasion that I became involved with the Physics Department at Okayama University, and had the pleasure of meeting up with Pr./Dr. B. Chenevier, Pr. M. Nohara and Pr. T. Suzuki, then involved in setting up the new I-Ma-C program.

In January 2020 I was awarded a JSPS grant for a Visiting Researcher position at AIST Tsukuba (3 months beginning January 2020, Pr. H. Eisaki host) for the study of superconducting materials. For the second part of my long visit to Japan, I am dedicated to both teaching and research at Okayama University, thanks to my attentive host Pr. M. Nohara as well as B. Chenevier. I am also giving a series of lectures for Kobe University, Graduate School of Engineering, in a program wishing to expand their course-work in material sciences in the English language.

I-Ma-C - Teaching in "Corona" mode

Teaching has always been a top priority during my career, and teaching in Japan has been a particular honor and pleasure. I was interested in joining the group of faculty members lecturing in the newly launched I-Ma-C program, because it is attractive in terms of teaching to Japanese students as well as a selection of prominent international students. Indeed, the students in Japan are very keen on fundamental physics, and their good work habits and respectful nature makes the experience very enriching.

Thanks to T. Suzuki, M. Nohara and B. Chenevier (URA at Okayama University) sensei and colleagues, I am really honored to participate in this ongoing project. I would like to put to good use my International background, my previous experience as director of a Master's program in Sorbonne



Lecturing in "on line" mode in the "Corona" time (Pr. Sacks and Nohara)

University for more than a decade, and my research experience as well.

The present course in the Master's program at Okayama is entitled "Superconductivity, from basic concepts to today's advanced research topics" and offers students a solid background in materials, but also insight into the most modern experiments and theories in the field. In my opinion, the general offering of courses in the I-Ma-C program is outstanding, both in breadth and depth of study. It should be very attractive and valuable to international students from all over the world.

During the covid-19 emergency, all my lectures were online but I also proposed weekly 'office hours' so that the students could freely pose their questions for discussion, or I could add some detailed points not covered in the regular lecture. This is a most satisfying format, since it offers a simple means to adjust the speed and level of a course to a high, but acceptable level for all students. In the week of June 15th in-class lectures will resume.

Next academic year, spring 2021, I am already planning to return within the framework of the ongoing collaboration between Okayama University and Sorbonne.

Scientific activities

My activities in Okayama have hardly been slowed down by the Covid-19 situation, fortunately. Prior to arriving in Okayama, I was able to travel and meet with many scientists in Japan, in Hokkaido, Tokyo, Kyoto and Hiroshima, just before the emergency declaration. As mentioned above, during the quarantine time, no travel outside the prefecture, on-line teaching and social distancing were strictly observed.

The ongoing collaboration with Pr. M. Nohara is very fruitful and, thanks to modern technology, we are able to communicate regularly with colleagues in Paris and in Tsukuba. I am happy to announce that we are writing the first of three planned articles on the collaborative work on the thermodynamic properties of cuprate superconductors.

Daily life at Okayama - Practical features

The daily life in Japan is without doubt an exceptional experience for a European or American such as myself. Here there is a very special attention to detail in the daily life, a respect for others that is reflected in the language and customs of Japan, that I find so agreeable and admirable. One learns very quickly to do likewise, to be attentive, to listen to the other person carefully, to be polite. My Japanese is very rudimentary, but one still picks up little phrases that are customary and polite, here.

There is so much to discover in Japan, the temples and gardens, the many trades, the art and calligraphy, and also the landscapes, the islands, etc.

I unfortunately did not have too much time to visit, and covid-19 also prevented me from much tourist visiting. However, I always enjoyed the colors, the food, the new sounds and sights while traveling either by the fantastic Shinkansen train, or their local airlines.





Okayama University campus is very attractive with many trees and plants and it is situated conveniently only a few kilometers from the main train station. Many shops and living quarters, relatively inexpensive, offer a very simple and agreeable daily life. In addition, one can get around the city easily by bus or bicycle, or on foot, if one is so inclined. I chose to acquire a bicycle, and enjoy the convenience of two wheels to go almost everywhere.

The Tsushima campus has very good accommodation for foreign students and invited faculty – I highly recommend.

It is very easy to buy good food in the neighborhood, or enjoy one of the many little restaurants in the neighborhood, or indeed closer to city center.

One of our favorites is the **J Terrace Cafe**, a lovely kissaten with a delicious daily 'obentou' (お弁当, left in the photo), located

next to the main administration building on Tsushima campus.

As a matter of conclusion:

In short, my half-year stay in Japan will have been successful on research, teaching and personal aspects. I am already impatient about my return date! next academic year, spring 2021, within the ongoing collaboration between Okayama and Sorbonne Universities.

