

The RÅC International Summer School 2023: Six days on “Cutting-edge Neutron and X-ray Research for a Sustainable Future”

Introduction

After the RÅC Summer School in 2022 took place in Varberg, Sweden, the research centre DESY organised this year's edition of the Röntgen-Ångström International Summer School – or RÅC-2023 in short –, as a six-day-event from 20 to 27 August 2023, in Lüneburg, Germany (<https://www.rac-school.org/rac2023>). This year's focal theme of the school was “Cutting-edge Neutron and X-ray Research for a Sustainable Future”. The school in Lüneburg brought together 52 young scientists in materials research from Sweden, Germany and various other European countries, such as Estonia, Latvia, Lithuania, France, Greece, as well as Ukraine and Israel. They all have very much enjoyed participating in a program ranging from high-level scientific lectures by international experts to social activities and an excursion.

The RÅC International Summer School is a German-Swedish collaboration, under the umbrella of the bilateral Röntgen-Ångström Cluster. The cluster as well as the school are co-funded by the Swedish Research Council, Vetenskapsrådet, and the Federal Ministry of Education and Research (BMBF). During the last years, 2020-2022, the school has undergone several changes and adaptations of its format. After the Russian military attack on Ukraine in February 2022, and in consequence of applying EU-wide sanctions against Russia, the German and Swedish partners of the RÅC School Steering Committee have decided to halt the former trilateral German-Swedish-Russian summer school cooperation, and to adapt the school's format to a bilateral format, and to open it further to young scientists affiliated to institutions not only from Sweden, Germany, but also from many other countries in the EU or even beyond.

Idea and aims of the school

The key idea of the RÅC Summer School is the training of the next generation of researchers in order to stimulate the best use of the most advanced analytical research infrastructures (RI), and to offer a training program for young researchers in materials science, who utilize neutrons and X-rays for their research. The RÅC Summer School attracts young scientists, including mostly PhD students, and also master students in their final year and early Postdoc scientists, to X-ray facilities and neutron sources in the Baltic Sea Region and beyond, and to illustrate to them the unique research opportunities at these facilities.

These RI are, for instance:

- Synchrotron radiation source PETRA III, DESY, Hamburg
- Free-electron Laser European XFEL, Schenefeld
- Free-electron laser FLASH II, DESY, Hamburg
- Synchrotron radiation source BESSY II, Helmholtz-Zentrum Berlin
- Research neutron source FRM II, Technische Universität München
- Synchrotron radiation source at MAX IV Laboratory, Lund University
- Neutron source European Spallation Source ESS, Lund (under construction)
- The European Synchrotron Radiation Facility ESRF, Grenoble
- Neutron Source at the Institut Laue-Langevin (ILL), Grenoble.

RÅC summer schools offer young scientists a high-quality lecture format with around 25 lectures on research opportunities and the latest trends in all types of materials research as well as structural biology. The lecturers are internationally renowned experts in their respective fields of research. Typically, one lecture is also offered by a representative of the European X-ray laser European XFEL. The young scientists are thus introduced first-hand to the fascinating opportunities of materials research with modern photon and neutron sources. They will also gain an insight into current trends and the latest developments in materials research.

Another aim of the school is to stimulate networking, and to bring roughly 50 young researchers into contact among another, and with roughly 25 international experts in materials research.

The school also addresses the topic "Start-ups and career opportunities at the interface between science and industry". Best practice examples are illustrated in a special slot, and this has become a regular component of the summer school.

The RÅC International Summer School has thus become a well-known and established summer school format. With its specific profile, the school has established its place in the context of other relevant summer schools. The German-Swedish MATRAC school and the European HERCULES school are also inviting young users of photon sources and neutron sources, but focus more on practical training in the experimental utilization of the facilities, while RÅC summer schools familiarize students with the latest research opportunities and research trends in the field of materials research with photons and neutrons.

The 2023-school in Lüneburg, Germany

The contest of the 2023-call for applications yielded 52 young scientists: 29 participants from German and from Swedish institutions, and 23 participants from institutions in Estonia, Latvia,

Lithuania, Poland, France, Greece, from EU-Associated countries Israel, and Ukraine, and indeed one participant from Japan, and one from Taiwan.¹

The scientific lecture program has covered a wide range of topics, comprised under six thematic days: “Introduction to X-ray and neutron sources” (basic lectures on the facilities, and on basic experimental techniques of scattering and diffraction), “Solar photovoltaics materials”, “Quantum matter and complementary methods”, “Application for catalysis”, “Techniques for magnetic and strongly correlated materials”, and finally “Application in engineering materials”.

26 internationally renowned scientists and experts from the relevant fields were invited as lecturers. At the end of each lecture day, a specific tutorial session was offered, where students could ask questions and discuss additional topics with the lecturers of the day in a relaxed atmosphere. This is a key feature of each school, and was also very welcomed and appreciated by the participants during the 2023-school.

A Poster session and a session where students presented their own research completed the scientific programme. This is an important element of the summer school, and contributes to gaining experience in presenting techniques for the young scientists.

For the first time in a RAC summer school, a special session was focused on “How to write a proposal (for beamtime)” in order to make the students fit for their own research work at large-scale facilities. As a keynote lecture on the last day of the school, the school attendants had the pleasure to welcome Professor Daniela Jacob, a renowned meteorologist, Director of the Climate Service Center Germany (GERICS), from Helmholtz-Zentrum Hereon, and visiting professor at Leuphana University, Faculty of Sustainability. Daniela Jacob gave a lecture on the great challenges of the ongoing climate changes.

It should be also mentioned that a special “award ceremony” session was part of the program, dedicated to thank Günter Kaindl very much for chairing the German part of the RAC Summer School Scientific Committee and supporting the development of the school format for many years, actually since its very first edition in 2013. Prof. Kaindl received DESY’s Silver Pin of Honor, handed over by DESY Director Prof. Helmut Dosch. On this occasion Prof. Ullrich Pietsch was welcomed as the SC’s new member and chair of the SC’s German part since January 2023.

The pleasant environment of the German middle-age city of Lüneburg contributed to a stimulating atmosphere with sufficient time for social and cultural activities. During the half-day excursion, the

¹ A special co-funding for participants from EU countries beyond Sweden and Germany, as well as from Ukraine and Israel was provided by the EU-project EURIZON, Horizon 2020 grant number 871072.

participants visited the German Salt museum of Lüneburg and enjoyed a coach trip throughout the Lüneburg natural heather environment “Lüneburger Heide”.

The 2023 RÅC International Summer School was evaluated by the participants as very successful, and reflected most positive by the participating students, as shown in figure 1 which gives the result of the evaluation with regard to one of the evaluation dimensions: “General subject and objectives of the school”.

One participant wrote in his email about his experience in attending the RÅC summer school in Lüneburg:

„... Attending the RÅC summer school has been an incredibly rewarding experience for me, and it has generated a passion to advance my knowledge of neutrons and X-rays. (...) I am very inspired by the insights gained during this program.”

Outlook

The next RÅC International Summer School 2024 is currently under planning, and expected to be organised jointly by Germany, Sweden, and Poland, and will most likely take place in the countryside close to Cracow (Poland). Our Polish partner IFJ PAN (The Henryk Niewodniczański, Institute of Nuclear Physics, Polish Academy of Sciences) will be co-organiser. In the following years the RÅC school will attract new locations in the Baltic Countries and in Denmark attracting students from EU countries including Associated Countries such as Ukraine and Israel.

The website of the school will typically announce the 2024-edition and open its next call somewhere in March 2024.

Martin Sandhop, DESY

Ullrich Pietsch, chair of Scientific Committee of the RÅC Summer School 2023

Picture 1: Group picture of RÅC Summer School 2023. Photo: DESY.

Picture 2. Participants of RÅC Summer School 2023 during a lecture. Photo: DESY



Figure 1: Result of the evaluation of the RÅC Summer School, with regard to the dimension “General subject and objectives of the school”:

Q1. General Subject and Objectives

Q1.1	The general objective / subject of RAC-2023 was clear to me	4,63
Q1.2	The RAC International Summer School met my expectations	4,63
Q1.3	The general content of the lectures was relevant to my own research	3,73
Q1.4	The RAC International Summer School improved my awareness / understanding of the subject	4,58
Q1.5	Overall, I was satisfied with the RAC International Summer School	4,80

