

## **NNSP School program 2017-2023, Final report**

In 2016, Nordforsk granted 10 MNOK to the School part of the Nordic Neutron Science Program. This is the final report related to this grant.



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**with input from Martin Månsson, KTH, Sweden; SwedNess teaching coordinator**

## 1. Background and the Nordic setting

The European Spallation Source (ESS) is one of the largest research structure investments ever in Scandinavia. The ESS is planned to have first beam on target in 2025 and user program running in 2027. Based on the related opportunities, Nordforsk in 2016 decided to launch the Nordic Neutron Science Program that would support a number of PhD stipends (actual number was 17) and a supporting wealth of activities with a network, a basic PhD course in neutron scattering, and a number of specialized schools. This initiative, with a total investment of around 60 MNOK, saw the participation of more than 30 institutions within the Nordic and Baltic countries, showing a very broad interest in the use of neutrons.

The first incarnation of the NNSP “basic course” or as it became known “the Nordic/Baltic neutron school” started in 2017, and the grant funded in total six Nordic/Baltic Schools of Neutron Scattering: 2017, 2018, and 2019 in Tartu (EST), 2021 online, and 2022, 2023 in Lund (S). All schools were co-organized with the Swedish national SwedNess program and included a heavy element of e-learning.

Other relevant Nordic programs within the same time frame are:

- The Swedish Foundation for Strategic Research funded in 2016 a 220 MSEK National Graduate School in Neutron Scattering, SwedNess. The graduate school is expected to train and graduate about 40 Ph.D. students until 2027, supporting a broad competence in neutron scattering-based research during this period.
- The Danish National Committee for Research Infrastructure (NUFI) has in 2019-2021 funded three so-called “Lighthouses” within materials science using neutrons and X-rays. These Lighthouses currently fund around 40 Ph.D. students, with the prospect of funding another round of 40 students in a second 5-year period starting 2024. Additional two lighthouses have been proposed, and there is an open call (April 2024) for one of them.
- In Sweden, the LINXS Institute of Advanced Neutron and X-ray Science is an advanced study institute that promotes scientific collaboration with respect to X-ray and neutron sciences. It is committed to maximising the exploitation, both nationally and internationally, of the large-scale facilities (notably MAX IV and ESS) to which Sweden subscribes.
- Denmark has established a partnership between universities, sector research, and the private sector about utilization of X-ray and neutron scattering within industry. This collaboration was in its first incarnation known as LINX, and is presently being refunded and reorganized.
- Norway has May 2021 established an agreement with PSI (CH) for Norwegian access to experiments at the SINQ neutron source. This agreement is for 6 years, giving Norwegian neutron scattering users access to 35% of available beamtime on one instrument, that can be distributed over several instruments (in the range of 50 days of beamtime per year). An IFE-funded post doc will be working at PSI during this period.

The Nordic/Baltic neutron school has collaborated with all these initiatives, with the purpose of coordinating efforts to maximize the benefit derived from available funding and to spread the competence of neutron scattering in the community as widely as possible. As students in the school, we have not limited ourselves

to educating Ph.D. students, although this has clearly been our main audience. We have also hosted post docs, young staff members, and a few M.Sc. Students.

The total number of students in the Nordic/Baltic Schools of the original period 2017-2019 was 89. Due to COVID and unspent budget, we extended with additional three schools: 2021-2023 with an attendance of 85. So we have been hosting an average of 30 students annually.

It was originally foreseen to back up the school program with hands-on exercises at the neutron facility at IFE. This facility was, however, prematurely closed in 2018, and the hands-on activity shifted to support students (upon a brief application) to participate in hands-on training activities at European facilities.

In Europe, there exists a number of schools similar to the Nordic/Baltic neutron School; most notably the Oxford School of Neutron Science and the ILL/ESRF "Hercules School". However, these schools are generally massively oversubscribed and would not be able to host all relevant Nordic/Baltic students. Hence, the NNSP school both for capacity and networking reasons there has been a clear place for a Nordic/Baltic neutron School, as we will also elaborate below.

## **2. Activities in the 2017 NNSP School; lessons learned**

### **2.1. Activities**

The 2017 NNSP School had five main activities

1. The Nordic/Baltic School of Neutron Scattering, held every year in September (except 2020), co-arranged with SwedNess.
2. Development of e-learning tools alongside a library of video lectures connected to the school
3. Hands-on training, initially planned to take place at the JEEP-II facility at IFE, Norway
4. Specialized Schools in sub-fields of neutron scattering
5. Tracking the Nordic/Baltic neutron community by bibliometric studies

In the future 2023 NNSP School, the above points 1, 2, and 3 will be continued.

In addition, some of the 2017 NNSP School budget was transferred to the NNSP network activity, which was a separate project, led by Martin Sahlberg, and has been reported earlier. In brief, the NNSP project contained the following six networks:

**Soft and biological materials;** Network leader: Reidar Lund, UiO

**Functional materials;** Network leader: Mogens Christensen, AU

**Magnetism and superconductivity;** Network leader: Pascale Deen, ESS

**Engineering, processes and real-space imaging;** Network leader: Luise Theil Kuhn, DTU

**Low-dimensional structures;** Network leader: Christoph Frommen, IFE

**Network for Young Nordic Neutron Scatterers (NYNNeS);** Network leader: Maja Hellsing, UU

These networks that were particularly active in the pre-COVID time, were also given the task of running the specialized schools. In practice, these schools were coordinated with the network meetings and the similar planned activity in SwedNess, to ensure critical mass and avoid duplicated efforts. For this reason, it makes no sense at this point in time to disentangle which specialized schools were held particularly as NNSP schools.

## **2.2 The effect of the School on the Nordic/Baltic Neutron community**

To track the Nordic/Baltic neutron communities, we have performed bibliometric analysis on all “neutron-related” publications with authors from any Nordic/Baltic country. We define a person belonging to the community, when two neutron-related publications have been registered with the person as a co-author. The bottom line is that all communities are growing, with Sweden as the clear growth motor. Reports on this topic, latest updated summer 2023, can be downloaded from the NNSP School home page:

<https://nnspp.nbi.ku.dk/>

To track the effect of the Nordic/Baltic Neutron School, we have again utilized our bibliometric studies. For the 89 students that participated in the school in the period 2017 to 2019, the numbers are

- 2+ publications: 31 (10 of these students even have 5+ publications)
- 1 publication: 12
- 0 publications: 40
- Students not from Nordic/Baltic countries: 6

It is common that the time lapse between a neutron experiment and the subsequent publication is 2-3 years, which would mean up to 6 years after the start of the Ph.D. project. For this reason, we have not investigated students participating in the courses 2021-2023. And for the same reason, we suppose that the 12 students with 1 neutron publication will have 2+ publications in a few years from now.

From the numbers and assumptions above, we estimate that the number of active Nordic/Baltic neutron users educated in the first three Nordic/Baltic Neutron Schools is 43 – corresponding to 52% of the Nordic/Baltic participants. This is a number we can certainly be proud of.

## **2.3. Lessons learned**

From running the NNSP School program, we have collected some experiences that can be used for the future schools. They are summarized as below:

- The Nordic/Baltic School works as intended. The learning outcome for the students is good, judged from their performance in the final test and testimonies from alumni. Upon discussion with alumni, the networking aspect seems to be working really well.

- The program content works well, and the coverage of e-learning is good. To facilitate more in-depth learning, cross-topic quizzes could be added in the program.
- The two-day intro program with Math and Physics is strongly appreciated by the non-Physics students.
- Our scheme of student evaluation works as intended. This allowed a few initial mishaps in 2017 to be eliminated. Since then, the student satisfaction has been very high. In addition, a few adjustments was made after the evaluation of the 2022 School, since the change of venue provided a new setting with new challenges and possibilities.
- Our selection of lecturers is in general well received. However, we should more carefully consider the gender balance for the future selection of lecturers.
- In 2021 and 2022, we were too late in inviting lecturers and students. This likely influenced the number of participants.
- We should improve the information on course material (notes), to streamline the coherence with and among lecturers. A new initiative with having (some) lecturers contributing to the notes will likely improve this topic.

## **Appendix:**

### **Persons involved in the NNSP School**

The NNSP School Board consisted of the 3 main applicants:

- Kim Lefmann, Univ. Copenhagen (DK): PI, responsible for the school
- Martin Sahlberg, Univ. Uppsala (S): Responsible for the NNSP Networking
- Bjørn Hauback, IFE (N): responsible for hands-on training

In practice, one more person was central to the NNSP school:

- Martin Månsson, KTH (S): school co-organizer, SwedNess Director of Studies

The NSM headquarters was placed at University of Copenhagen (UCPH, DK) with Kim Lefmann as coordinator of the Course from the NNSP side and Martin Månsson as coordinator from the SwedNess side. A School Secretary (0.1 FTE) was placed at UCPH.

### Network leaders:

- Mogens Christensen, University of Aarhus (Functional Materials)
- Pascale Deen, ESS (Magnetism and Superconductivity)
- Luise Theil Kuhn, Technical University of Denmark (Engineering and Processes)
- Christoph Frommen, IFE (Low dimensional structures)
- Reidar Lund, University of Oslo (Soft and Biological Materials)
- Gunnar Palsson, Uppsala University, (NYNNeS)

### Other applicants:

- Heisi Kurig, University of Tartu (local organizer) – **replaced in 2019 by Piret Pikma, U Tartu**
- Linda Udby, University of Copenhagen (e-learning) – **withdrew in 2022**
- Isabel Llamas-Jansa, IFE, Kjeller (hands-on training)
- Magnus Sørby, IFE, Kjeller (hands-on training)
- Max Wolff, Uppsala University (teaching committee)
- Marite Cardenas, Malmö University (teaching committee)
- Thomas Holm Rod, ESS-DMSC

### Steering Group:

- Kenneth Knudsen, IFE + NONSA
- Kell Mortensen, University of Copenhagen + DANSSK
- Maths Karlsson, Chalmers University + SNSS
- Arno Hiess, ESS
- Fredrik Melander, Science Village Scandinavia + NNSP Program Committee

### **The Nordic/Baltic Neutron School 2017-2023, arranged by NNSP and SwedNess**

Having run the School six times between 2017 and 2023, we believe that the scientific program has reached a level of maturity. The program is found from the home page for the 2023 Nordic/Baltic School:

<https://eventsignup.ku.dk/6thsummerschoolofneutronscattering>

As for the selection of lecturers, we are in general most satisfied with their quality and engagement. However, there is room for improvement with respect to gender balance. Excellent and relevant female lecturers exist in the Nordic/Baltic countries, and we should be kept in mind when planning for future schools.

Below, we report for the individual schools

**September 2017:** 43 students participated, of which 20 were from SwedNess, and 7 from the Baltic countries. In the picture, we present a picture of all students and some of the teachers.

**September 2018:** 20 students participated, of which 1 was from SwedNess, and 3 were from the Baltic countries. This school was also open for qualified M.Sc. Students, and 3 of the participants was in this category. Below, we present a School picture from outside the Tartu conference hotel V-SPA.

**September 2019:**

27 students participated, none of which were funded by SwedNess. There were 14 students from the Nordic countries, 8 students from the Baltic countries, 2 from the rest of Europe, and 3 from East Asia. Worth noting is that we had in 2019 our first student from Finland. Below, we present a School picture from outside the one of the venues: Tartu Loodusmaja.



**2020:**

Unfortunately, the school had to be canceled due to the Covid-19 pandemics.

**October 2021:**

Due to the pandemics, the school was held online. Since a new suite of SwedNess PhD students had at that time arrived, the attendance was again high: 41 students, all from the Nordic/Baltic countries

**September 2022:**

After the pandemics, the venue was shifted to Lund (S), where the school was held one week at LINXS and one week at the ESS. The attendance was only 17 students, hereof 16 from the Nordic/Baltic countries. One reason for the limited attendance was that the school was announced later in the year than the previous schools.

**September 2023:**

Again, the school was held in Lund. Most of the days, the school was held at LINXS, with 3 days at ESS and one day at MAX-IV.

The full programme for this school can be found at:

<https://eventsignup.ku.dk/6thsummerschoolofneutronsattering>

In general, SwedNess has covered 50% of the common expenses, plus 100% of the specific expenses for the SwedNess students.