

Program for Nordic Science Institutes

NordForsk today contributes to Nordic impact in research by funding projects within selected priority areas that vary over time. It is important for the Nordic research cooperation to also be able to advance and support a limited number of long-term scientific activities at the international forefront, with significant long-term Nordic benefits that are continuously developed in line with international progress. To enable this, a new financing instrument, the *Program for Nordic Science Institutes* is outlined here as a complement to project support. The goal of the program is to enable long-term scientific activities with high Nordic added value. A rationale for the Nordic science institutes may be summarized as: "Institutes promoting scientific excellence for the benefit of the Nordic region".

Funding from NordForsk shall be time-limited, renewable and subject to sharp in-depth evaluation.

The number of Nordic science institutes is assumed to be small and the total budget is expected to be approximately 20 MDKK (which is currently the budget for the cooperation bodies).

Purpose of program

Enable and give long-term support to excellent research of significant long-term Nordic benefit.

The distinguishing feature of the program is that it aims to provide long-term funding for activities of significant Nordic long-term benefit based at Nordic institutes with considerable autonomy within host universities. This is based on the realization that such activities exist and are threatened in the current system of short term project funding and that activities of this nature are difficult to pursue at individual universities. To provide evidence for the existence of the targeted activities, the long-term Nordic impact of Nordita is presented as an example in the Appendix.

Prerequisites and evaluation criteria for funding

- Scientific excellence
- Nordic benefit
- Organizational freedom within a university
- Co-financing from one or more national research councils, as well as from the host university, at least at the same level as from NordForsk
- Activities available for all researchers at all Nordic universities on the same terms and conditions

Since high-level scientific activities require a corresponding supporting environment, the involvement of internationally leading researchers is essential. A Nordic science institute is expected to be: i) a natural meeting place for Nordic and international scientists, ii) incubator of new (related) directions in the research field, iii) a Nordic actor in the international context, and iv) an important center for researcher education and talent recruitment to the Nordic region. Finally, a strategy and potential for obtaining further competitive external funding should be demonstrated.

Organization

A Nordic science institute has a university as its principal administration body and thus the overall and final responsibility lies with this host university. However, a Nordic science institute is not a regular research institute or department in a university and this shall be reflected in the organization of the unit within the university. The Nordic science institute shall be led by a board with significant Nordic representation, where the Nordic representatives should be proposed by the research councils. The Nordic science institute shall be given considerable freedom within the host university. The Institute Board should have a broad mandate and the host university should commit itself to comply with the decisions of the board.

Financial support

Financial support is provided by NordForsk for five years at a time with MDKK 2-6 / year, and is renewable subject to a sharp in-depth evaluation.

Evaluation

A sharp in-depth evaluation is carried out well in advance of each new decision on support (approximately two years before the end of the five-year period). The evaluation focuses mainly on three aspects: scientific excellence, Nordic benefit and organization. Since long-term planning and continuity is a prerequisite, the institutes are evaluated primarily on the basis of what they have achieved, with a particular focus on near-term, and not on the basis of plans for the future. For an institute of this type, the most credible forecast for the future is based on the activities that are in place and on what has been achieved in the past.

Establishment of new Nordic Science Institutes

New Nordic science institutes should be established only very sparingly and there should not be open calls for such establishments. The research councils in the Nordic countries may propose to NordForsk the establishment of new Nordic science institutes. In connection with such a proposal, the research council, or councils, shall undertake to co-finance at least at the same level as proposed to be financed by NordForsk and so shall the proposed host university. Furthermore, NordForsk can initiate new institutes in collaboration with research councils. A new institute is unlikely to be evaluated on previous qualifications but is given an initial support for an eight-year trial period with a simpler mid-term evaluation after three years (after which the support can be terminated based on the outcome of the evaluation), and a regular sharp in-depth evaluation after six years, which forms the basis for decision of a possible continuation.

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Appendix

Nordita – its Nordic profile and long-term impact

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Nordita is a common Nordic resource, with a long-term Nordic impact, for the advancement of theoretical physics at the highest level. This [impact is most easily summarized in the fact that 138 Nordita alumni](#) (former Nordita post-docs, assistant professors, and corresponding fellows) have obtained permanent positions at universities in the Nordic countries.

Theoretical physics is a key area of the basic research fields and always in rapid development. Theoretical physics is a cornerstone of all of modern quantitative science. It is perhaps the highest-impact, lowest-cost area of basic research. The field advances our fundamental understanding of the nature, from the very small to the extremely large, and seeds the technologies of tomorrow. There are countless examples of **how fundamental physics drives innovation and theoretical physics is always at the root of it**. Perhaps no other field of science can have as deep and as broad of an impact on society and how we understand the universe. Beyond the technologies that may emerge from physics is the intellectual journey of discovery. Scientific research is a global effort, and Nordita is a unique Nordic hub in a common international pursuit of new knowledge. It educates the next generation of thinkers, providing innovators that will go on to apply their own analytical and technical skills – within or outside of the physics research community – and propel human knowledge even further for the understanding and benefit of all.

In such an international research field, flexible cooperation across national borders plays an important role especially in countries in which only relatively few theoretical research centers are present. Nordita provides a unique research infrastructure, consisting of internationally competitive in-house research combined with two key components, namely researcher education and scientific programs attracting more than 1000 researchers yearly. **This infrastructure is essential for progress by connecting researchers within the Nordic countries, and the Nordic countries with the global research community.**

Nordita's Nordic profile reflects clearly in its activities, in which the Institute gives preference and pays special attention to the needs of Nordic researchers. This shows in the **visiting PhD program** (intended mainly for candidates from the Nordic countries, though exceptions can and have been made), the **Nordic network meetings**, the high percentage of **Nordic participants in scientific meetings**, and the large fraction of **Nordita alumni** that have gone on to become faculty at Nordic universities.

While on the one hand the institute fosters the **connectivity of researchers within the Nordic countries**, on the other hand it also **connects the Nordic countries with the international community**. This includes the leading well-known research centers in the entire world, but also those in countries such as China, Korea, India and Brazil, that are currently investing heavily in science and technology, undergoing a rapid development. Nordita has been, thanks to its unique position in the Nordic countries, at the forefront of establishing relations and cooperations with the best institutes in these countries.

The postdoctoral fellowship program at **Nordita attracts young researchers** from all five Nordic countries and also serves to bring international talent into the Nordic region. Nordita's advanced summer and winter schools for graduate students and postdoctoral fellows supplement the regular curriculum at Nordic universities, and bring in knowledge about the most recent international developments. Nordita is a window to the world for Nordic graduate students via schools and conferences offered throughout the Nordic countries, in which young researchers can make contacts essential for their scientific growth.

One of the most important goals of Nordita has been to **organize activities for the Nordic researchers and PhD students that could not be organized by a single Nordic university because too few people are working in a certain research field**. These, however, can and have

been organized by Nordita collecting all interested people at the Nordic level. Examples of this are the Nordic meetings on fast developing fields, like those in quantum information, complex networks, advanced materials, gravitational waves, and particle physics. Another example is the advanced courses for post-docs and PhD students that again cannot be organized at the level of a single Nordic university due to the small number of people involved. At least one such course is organized by Nordita every year. Finally, the more recent example is the organization of programs, lasting typically four weeks, on various aspects of theoretical physics, which bring together experts in any particular field of theoretical physics. Particular importance in the organization of these programs is given to have a numerous Nordic participation.

The Nordic profile is also apparent from the Institute's organization. Nordita is governed by its Board consisting of members from the five Nordic countries. The Board makes decisions on the scientific direction and the strategic development of the Institute. In these decisions, the Board relies on input from its Scientific Advisory Committee. In the hiring of postdoctoral researchers the institute consults Research Committees that have members from each of the Nordic countries. These committees are responsible for the initial rankings in the postdoc recruitment process. Researchers at Nordita have extensive (documented) collaborations with other institutes in the entire Nordic region.

The large benefit that Nordita has from being a Nordic, rather than merely a national organization, is its wide reach on the expertise in the Nordic countries. This is an advantage for both researchers in the Nordic countries, by using their knowledge base more efficiently, and for the international community, by making the Nordic excellence apparent and more accessible. As a national institution such a broad benefit for the community would not be achievable.

Nordic added value

138 Nordita alumni (former Nordita post-docs, assistant professors, and corresponding fellows) have so far obtained **permanent positions at universities in the Nordic countries**. This documents that the education and expertise provided at the institute directly benefits the research infrastructure at Nordic universities.

Approximately one third of the visitors and program/workshop participants come from the Nordic countries. A Nordic added value is also the winter schools and network meetings.

Nordita organizes activities that cannot be organized by a single Nordic university. The various institutes organizing programs in the world (GGI in Florence, Kavli Institute for Theoretical Physics (KITP) in Santa Barbara, MITP in Mainz, APCTP in Pohang) are all connected to universities, but have, like Nordita, large autonomy. Some of them (APCTP, KITP) were indeed created following the Nordic example. Like the programs, schools in advanced topics in theoretical physics cannot be organized by a single Nordic university because of the small number of PhD students and post-docs they have in these fields. But if one collects PhD students and post-docs from the Nordic countries, then the number is high enough to make it possible to organize them. This has also the great advantage of creating a closer contact among the Nordic PhD students and post-docs working in a specific direction of theoretical physics.

Nordita's most relevant role for theoretical physicists in the Nordic countries is to act as a **facilitator for new collaborations and the development of ideas**, by its many scientific meetings and the training of researchers, researchers who go on into other Nordic countries and contribute further to research and education. The institute and its facilities allow Nordic scientists to more efficiently use existing knowledge resources, and to better connect to the international community.

Nordita plays furthermore a key role in **attracting and recruiting talent to the Nordic region**. At the junior level, this includes the Nordita Fellows that come to Nordita for a two-year period, selected for their academic excellence and independence. Typically these young researchers bring in new

knowledge and expertise, and at the same time receive researcher education via their interactions and collaborations with the local staff and many visitors. Furthermore, at the tenure track level Nordita has recruited excellent upcoming research leaders to the Nordic region. This has been achieved in collaboration with Nordic universities, offering a five-year dual position with Nordita and the host university, eventually leading to tenure at the latter institution. The research environment offered by Nordita has proven an extra attraction to recruit these researchers in fierce international competition. Finally, also at the senior level has Nordita managed to recruit the absolute top.

To offer this unique research service to scientists from the Nordic countries and to attract researchers to this part of the world, Nordita needs Nordic core-funding which enables long-term planning. The Nordic value that the institute adds cannot be maintained on short-term or project-bound funding. Nordic and Swedish core-funding together allows Nordita to have its unique activities and status. Nordita's scientific excellence and infrastructure has furthermore led to a **substantial additional benefit in the form of project-bound funding (e.g. from ERC, VR, KAW, Villum) which directly enhances and benefits the Nordic investment in Nordita.**

It should also be emphasized that since its inception, Nordita has been responsible for **introducing novel research fields to the Nordic region**, therewith ensuring that Nordic theoretical physics has been internationally competitive, always being at the cutting edge and constantly pushing forward. This has included in the past research areas such as astrophysics and complex systems. In line with this tradition, Nordita is currently (thanks to a generous strategic grant from the Knut and Alice Wallenberg Foundation) expanding its research activities building up two world-leading groups in quantum information and quantum processing and complex dynamical networks respectively. With the advances in quantum computers, artificial intelligence and big data, this endeavor could not be more timely. Nordita was selected to host this initiative thanks to its excellent scientific infrastructure and successful experience with starting up new research fields. There is no doubt that via Nordita's numerous Nordic activities and connections, this initiative will benefit the entire region.

Last but not least, it takes decades to build up a world-class research institution. Thanks to its eminent history and continuous development, Nordita has managed to become a world leader in the field of theoretical physics and can as such be considered to be a **true brand**. Nordita is well known and highly respected throughout the entire world. That reputation is important in itself, and provides a unique Nordic value.

Appendix (summary of supporting numbers)

Nordita often host visitors for purposes other than programs, conferences, or workshop. Those visitors range from individual collaborations, to seminar speakers, all the way to various meetings. As a whole Nordita has hosted 1242 such visitors since statistics started to be measured in 2009, and 424 (34.1%) of them has been from a Nordic country or had a Nordic affiliation. As Nordita has been growing its reach across the world the visits from academics of a Nordic country has still remained in the 20-30% range.

https://nordita.org/statistics/summary_visitors/index.php

Similarly, when it comes to scientific programmes, workshops, conferences, or schools Nordita has since 2009 hosted 10790 participants, where 3627 (34%) of them has been from a Nordic country or had a Nordic affiliation. And, for the last three years Nordita has maintained the number of participants from a Nordic country around 30%:

In 2017, out of 1214 participants 360 (30%) were from a Nordic country.
In 2018, out of 1031 participants 301 (29%) were from a Nordic country.
And in 2019, out of 1667 participants 496 (30%) were from a Nordic country

https://nordita.org/statistics/nationality_programs/index.php

Since 2009, Nordita has accommodated 62 fellows, 22 (34.5%) of them has been/are from a Nordic country or had a Nordic affiliation.

https://nordita.org/statistics/alumni_statistics/index.php

Up to 2015 (when a large evaluation of Nordita by NordForsk was made) Nordita had total 138 permanent employed professors in a Nordic country that were previously employed at Nordita. The numbers by country are:

Sweden: 36

Norway: 26

Finland: 30

Iceland: 7

Denmark: 39