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Assessment Report for the Nordic Institute for Theoretical Physics NORDITA

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1. *About the Nordic Institute for Theoretical Physics NORDITA*

The *Nordic Institute for Theoretical Physics (NORDITA)* carries out research in theoretical physics, with a focus in particular on enhancing Nordic science and serving as a platform to the world for Nordic physics.

NORDITA was founded in 1957 as the Nordic Institute for Theoretical Atomic Physics on the premises of the Niels Bohr Institute at Copenhagen University. Until 2006, NORDITA was financed by and organized directly under the Nordic Council of Ministers (NCM). Following a decision to nationalize all Nordic research institutes of the NCM, NORDITA was in 2006/2007 relocated to Stockholm, where it is jointly hosted by Stockholm University (SU) and the Royal Institute of Technology (KTH) at the AlbaNova University Centre, a joint venture of SU and KTH situated in the immediate vicinity of the two universities.

NORDITA's mission is to achieve scientific excellence through cutting edge research and to promote Nordic and international co-operation in theoretical physics. The central areas of study are astrophysics, cosmology and gravitation, particle physics, and condensed matter physics. Over the years, the scope of NORDITA activities has widened to include new and emerging areas while maintaining a strong focus on excellent research in basic theoretical physics. Today, researchers at NORDITA are engaged in research over a broad range of topics and includes (in addition to the central areas mentioned above) biological physics, materials physics, nuclear physics, and statistical physics and complex systems.

The scientific staff of NORDITA consists of the Director, three permanent professors, and five assistant professors (some are five-year fixed-term positions; some are in joint positions with other universities). In addition there is a fellowship program for Nordic and international postdocs --- the "NORDITA Fellows". The institute's activities include numerous one-month Scientific Programs, shorter conferences, an extensive visitor program for scientists from all over the world, and symposia and summer/winter schools arranged by NORDITA alone or in co-operation with institutes in other Nordic countries.

NORDITA is governed by a board consisting of one member and one alternate from each Nordic country and a board chairman nominated by NOS-N, the joint committee of the Nordic natural science research councils. The board appoints the director as well as a number of Nordic scientific committees (representative of all five Nordic countries). These committees evaluate applications for NORDITA Fellowships and Programs and advise the board on scientific and educational matters.

NORDITA is funded by KTH and Stockholm University, the Nordic Council of Ministers, and through grants of the Swedish Research Council. The total budget in 2014 was approx. SEK 33.7 million. Of the total, 12.6 million was covered by project funds and is dedicated to specific research projects, while 21.1 million was the amount available for all of NORDITA's activities.

2. Assessment of the Panel of Experts

2.1. Introductory remarks by the Panel of Experts

The framework of this assessment is based on an assignment and terms of reference as provided by NordForsk (described in annexes 1 and 3): Accordingly, the "Peer reviewers are expected to use their expertise to assess the scientific quality and relevance of the Nordic co-operation body within its own field of research, in a Nordic and international context. The main question is to find out how added value has been created through the co-operation and what the role and status of the Nordic co-operation bodies are in the Nordic region/internationally."

The assessment is based on and limited to:

1. The material made available to the reviewers, mainly a self-assessment prepared by NORDITA
2. Interviews conducted with key staff, research fellows, and Board members at the institute during a one-day meeting held in Stockholm on 23 April 2015 (list of participants included)

Within the context of these limitations the Panel of Experts have summarized below their jointly held views on the assessment questions:

a) What is the significance of the Nordic co-operation body in terms of scientific results in its field in the Nordic region and internationally?

b) How is added value created through the Nordic and international co-operation?

2.2. *The significance and added value of the Nordic co-operation body in terms of scientific results in its field in the Nordic region and internationally*

Research profile of NORDITA

NORDITA is a world class research institute within and across theoretical physics, focusing on research excellence and having close coupling to the Nordic and international research arena.

The main research focus is on theoretical condensed matter physics, particle physics, cosmology and astrophysics. There are also recent developments in new areas, such as climate physics and biophysics. These topics are pursued in an interdisciplinary manner.

In connection with the move of NORDITA to Stockholm, the institute has gone through a phase of renewal including appointment of high caliber new faculty given that the entire complement of research faculty had reached retirement. Some emeritus faculty remain active.

NORDITA impressed the Panel of Experts with the quality and scope of the research. The Panel was also impressed by the ability of NORDITA to provide an environment which enables researchers both to explore deep questions and at the same time provides opportunities for synergy across disciplinary boundaries.

Research activities

Core activities comprise fundamental research carried on by the permanents scientific staff, assistant professors, post-doctoral fellows and graduate students; hosting and organizing extended visitor programs and workshops; summer schools and master classes.

A key feature of NORDITA is that it annually recruits a high quality cohort of young researchers who are free to develop their own programme of research supported by the faculty of NORDITA. NORDITA also supervises graduate students in collaboration with the neighboring universities. This provides a pool of highly qualified researchers for the Nordic region as well as internationally.

The quality of NORDITA is evidenced by an extensive track record of publications in leading journals, external grants, citation records, and international indicators of esteem. Highlights include an unusually high success rate for ERC advanced grants and 10-year grants of the Swedish Research Council. It is also notable that some of the fixed-term assistant professors were able to continue their research at NORDITA on competitively awarded grants. The success in hiring top candidates for the assistant professors and research fellows is evidence that young researchers consider NORDITA an attractive venue in which to develop their careers. The success rate of the junior faculty finding permanent academic jobs is unusually high by international standards.

The junior faculty enthusiastically supported the unique research environment which they feel combines academic freedom with exposure to the leading scientists in the international community on a regular basis through the program of workshops at NORDITA.

The Panel of Experts felt that, adjusting for scale of funding, NORDITA is competitive with other international institutes of this type known to the reviewers (comparable institutes include Max Planck Institute for the Physics of Complex Systems in Dresden, KITP Santa Barbara).

Merits and Excellence of key staff

The permanent faculty have outstanding research records, as evidenced by CVs and publication based metrics, invitations to international conferences and other esteem indicators.

Three out of four NORDITA permanent staff are relatively new to the institute having been recruited in the past few years. The Panel of Experts is of the opinion that the recruitment process has been highly successful. The Panel of Experts have a high level of confidence that these new appointees will have a positive impact and will thrive in their new environment.

The non-permanent faculty of assistant professors and research fellows identified the permanent faculty as one of the main attractions for working at the institute, as they provide important scientific leadership.

Nordic profile and relevance

It is the opinion of the Panel of Experts that NORDITA is a Nordic rather than specifically national (Swedish) institute. It provides a platform for profiling Nordic science to the international community and vice versa. Its governance is pan-Nordic. The resources of the institute are freely available across the Nordic region. The cohort of young researchers are drawn from across the Nordic region as well as internationally.

The composition of the Nordic Board (nominated by the national research councils of the Nordic countries) ensures that interests across the Nordic region are represented. The Board is directly responsible for governance of the institute and all major decisions.

NORDITA is formally an entity of the Stockholm University and The Royal Institute of Technology KTH, and is governed by its Nordic Board. This grants it a degree of independence, which the Panel of Experts feel is important in maintaining NORDITA's status as a Nordic resource.

The co-operation with universities in the Nordic countries could be further strengthened by a wider programme of joint positions, a need that NORDITA recognizes.

The alumni lists provided by NORDITA are impressive and document that a large number of faculty at Nordic universities within the field of theoretical physics have held positions at NORDITA. Former NORDITA fellows create a strong network throughout the Nordic region and internationally.

The brand

Internationally, NORDITA has a strong reputation for scientific excellence. The continued existence and support of such an institute sends a strong signal that the Nordic region takes very seriously its role as an international player at the cutting edge of science.

The NORDITA brand is regarded very highly by NORDITA staff and partners.

Theoretical physics has a strong history in the Nordic countries that pre-dates NORDITA. The institute NORDITA has built on this strength to establish its brand. The brand has been built up through many years and is now an asset in attracting high-level people to the Nordic region.

The NORDITA brand is based on the high level of scientific output. NORDITA's ability to fulfil its mission is enhanced by its high degree of independence, which it currently enjoys. An important factor is the availability of core funding, which has primarily come from the Nordic Council of Ministers.

How added value is created

NORDITA functions as a Nordic "hub" for research and research related activities in theoretical physics, attracting human capital within and to the Nordic region.

Human capital is the biggest asset of NORDITA. The institute gives the permanent scientists the resource of their own time, and a supportive academic environment. This enables the permanent staff to lead a comprehensive academic scientific programme that is internationally competitive, attacks topical fundamental problems and is broad in scope.

NORDITA is a venue for attracting and training highly qualified manpower. It develops the next generation of young scientists and gives them an opportunity to establish themselves in the international community of researchers.

It also potentially provides highly trained individuals whose quantitative, mathematical and modeling skills are valuable for the industrial and commercial sectors.

The possibility to broaden their own research scope through the stay at NORDITA and to co-operate across disciplinary boundaries was highlighted by many assistant professors and fellows as an important aspect of life at NORDITA. This is enabled through the academic freedom provided at NORDITA, combined with the caliber of the senior faculty and the possibility to meet and co-operate with excellent researchers, especially through the activities hosted by NORDITA.

Importantly, the profile of NORDITA is international, rather than specifically Nordic. This provides added value. NORDITA is a resource for attracting leading international academics to the Nordic region.

NORDITA provides a platform for building the teams necessary to make internationally competitive grant proposals, as evidenced e.g. by the success rate of obtaining ERC advanced grants.

The international profile of NORDITA supports individual researchers in gaining access to international large-scale programmes.

Future perspectives

NORDITA has successfully put in place a team of outstanding research faculty and the prospects for generating outstanding scientific results are very positive.

NORDITA has recently hired a new Director. She is an accomplished scientist with a strong ongoing research program. The Panel of Experts were impressed by her energy and ambition and they believe those will be positive factors for NORDITA's vitality in the future.

Core funding is important to maintain the position of NORDITA as an independent leading scientific institution.

The Panel of Experts was encouraged by the increasing level of co-operation with Nordic universities through joint positions and felt that this activity could be further expanded.

Some recommendations for future development

The Panel of Experts sees that increased interaction with industry would be beneficial for NORDITA. Such interactions could span the range from public-private research collaboration to appointment of adjunct professors seconded from industry. Some institutes form an interface with industry by appointing high profile members of the private sector to their board of directors. In as much as that would be possible for NORDITA, it would enhance the visibility of NORDITA in the private sector and it could enable employment opportunities there for the non-permanent research staff of NORDITA.

Two years post-doctoral positions only provide a short time to create opportunities for future positions. The senior longer term staff need to continue to ensure that these young researchers are guided in their futures beyond NORDITA. NORDITA could also consider possibilities to extend the fellows for a third year, either in co-operation with Nordic universities or by other funding opportunities (such as EU COFUND etc.).

Outreach activities are currently on the responsibility of the Director. Hiring professional dedicated staff for outreach would more efficiently support this important activity.

Conclusions

NORDITA is a strong research institute, built up during decades and has unquestionably brought added value in many ways to research on theoretical physics in the Nordic countries, as exemplified in this report, above all by creating a place for researchers to meet and work jointly, and by attracting international top researchers to the Nordic countries.

NORDITA is proud of their ability to renew themselves and to follow new developments in research – this ability is important if the institute is to preserve and consolidate its status and further develop and prosper.

The Panel of Experts strongly hold the view that the Nordic countries also in the future will benefit from having a unique asset like NORDITA, making the Nordic region visible and an attractive partner on the international science arena. The continued existence and support of such an institute sends a strong signal that the Nordic region considers itself as an international player at the cutting edge of science.

Annex 1: Background and Framework of the Evaluation

Background to the Assignment

In December 2013, the Nordic Council of Ministers' Committee for Senior Officials on Education and Research decided on changes in their funding allocations, meaning that NordForsk will from 2017 onwards govern the research funds that were previously earmarked for the following five *Nordic co-operation bodies:*

- Nordic Institute for Theoretical Physics (NORDITA), owned by KTH/Stockholm University
- Nordic Institute of Asian Studies (NIAS), owned by the University of Copenhagen
- Former Nordic Sámi Institute (NSI), owned by the Sámi University College in Kautokeino
- Nordic Volcanological Centre (NORDVULK), owned by the University of Iceland
- Nordic Institute for Maritime Law (NIfS), owned by the University of Oslo

In connection to this decision, NordForsk was tasked to perform an assessment of the scientific quality and relevance of these five Nordic co-operation bodies.

Framework of the Assessment

Aims

The aim of the assessment was to assess the scientific quality and relevance of the Nordic co-operation body within its own field of research, in a Nordic and international context.

The main assessment questions defined were:

- *What is the significance of the Nordic co-operation body in terms of scientific results in its field in the Nordic region and internationally?*
- *How is added value created through the Nordic and international co-operation?*

The results of this assessment will be used to assess the quality and relevance of the five Nordic co-operation bodies within Nordic university co-operation today, while decisions on possible future funding will be made through a separate process.

Assessment Process

The assessment was overseen by a Special Advisory Group appointed by the Board of NordForsk and consisting of the following members: Chancellor emerita **Krista Varantola**, Finland (Chair), Dr. **Agneta Bladh**, Sweden (Vice Chair), Vice-Chancellor emeritus, prof.

Jens Oddershede, Denmark, Pro-Rector **Kenneth Ruud,** Norway, and Director General **Hallgrímur Jónasson**, Iceland.

The assessment included a self-assessment performed by the Nordic co-operation body as well as peer review performed by an international external Panel of Experts.

The Panel of Experts for the Nordic Institute for Theoretical Physics NORDITA included the following external and independent experts:

Professor Ignatios Antoniadis, Theory Division at CERN, Geneva

Professor Sandra Chapman, Centre for Fusion, Space and Astrophysics, Physics Department, University of Warwick,

Professor Gordon Semenoff, University of British Columbia (UBC), Vancouver, Canada

Self-assessment

The self-assessment of the Nordic co-operation body was issued in December 2014 and submitted by the end of February, 2015. The self-assessment consisted of

A Fact Sheet, containing facts from the past five years (2010-2014) on main research related activities (e.g., staff, publications, main research projects, researcher training, visiting researchers, infrastructure etc.)

A Self-assessment report, with reflections about the research activities of the co-operation body; its Nordic added value; its stakeholder relations; Nordic university co-operation in general; and future perspectives of the Nordic co-operation body.

The self-assessment of the Nordic Institute for Theoretical Physics (NORDITA), is enclosed in annex 2.

Peer review

The peer review of the Nordic co-operation body was performed by the external Panel of Experts named above, and according to detailed guidelines of NordForsk concerning the aim of the peer review, the role of the reviewers, the review process, and confidentiality and impartiality issues. The guidelines for reviewers are enclosed in annex 3.

The peer review was based on the following written material made available to the reviewers in the beginning of March 2015:

- The fact sheet compiled by the Nordic co-operation body
- The self-assessment of the Nordic co-operation body
- Web page, central strategy documents, and annual reports (2010-2014) of the Nordic co-operation body

Other recent evaluations of the Nordic co-operation body and/or its host institution, as well as recent evaluations of relevant scientific disciplines in the Nordic countries were consulted in the assessment as secondary material.

The peer review culminated in an assessment meeting, including site visit, interviews and group discussions.

The report of the Panel of Experts was finalized after the assessment meeting and is enclosed in chapter 2.

Assessment meeting

The assessment meeting was organized on 23 April 2015 at the Nordic Institute for Theoretical Physics NORDITA in Stockholm, Sweden.

During the meeting, the international Panel of Experts and the Nordic Special Advisory Group met representatives of the Nordic co-operation body and its host universities. Time was allocated for interviews and group discussions in order to clarify any issues of importance for the final assessment of the scientific quality and relevance of the Nordic co-operation body.

The agenda and participants of the meeting are found in annex 4.

Role of the Special Advisory Group

The Special Advisory Group appointed by the Board of NordForsk carried the responsibility of overseeing the review process and the review meeting. The Special Advisory Group will summarize its recommendations to NordForsk concerning Nordic university co-operation, in a separate report to be finalized early 2016.

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