

Nordita –The Copenhagen Years: A Scrapbook



Edited by
Einar Gudmundsson, Helle Kiilerich,
Ben Mottelson, and Christopher Pethick

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Nordita

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Cover illustration. Detail from a photograph of Blegdamsvej 15 and 17
with Helle Kiilerich's Fiat (around 1990).

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Preface

The aim of this compilation is to give a history of Nordita and an impression of life at the institute during the half century it was in Copenhagen. No attempt has been made to produce an ‘academic’ study in a uniform style, and editing of the individual contributions has been performed with a light hand. In addition, there is a chapter describing the events leading up to the creation of Nordita.

Scientifically and socially, Nordita and the Niels Bohr Institute enjoyed a closely knit symbiosis, despite their different governance and sources of finance. Nordita built on the long traditions of the Niels Bohr Institute, and consequently the descriptions represent an account of life on Blegdamsvej seen from a Nordita perspective.

We are sorry for the long time it has taken to complete this work: there are many reasons for this, some predictable, others not.

We wish to express our heartfelt thanks to all of those who have taken the time to write, and we hope that this collection will help preserve memories and experiences at Nordita that could provide inspiration also in the future.

In the course of our work we have enjoyed the whole-hearted support of Nordita and the Niels Bohr Institute. We extend a special word of thanks to the Niels Bohr Archive and its director, Christian Joas. We are grateful to Felicity Pors and Rob Sunderland at the Archive for assistance with illustrations. Tobias Heinemann has been an enormous help with the thorniest L^AT_EX problems. Helle thanks her brother, Steen Schousboe, for advice and support.

For help in identifying people in pictures we thank Volodya Mineev at the Landau Institute, Sasha Chernyshev from the University of California, Irvine, and Paolo Di Vecchia.

Over the years, the names of a number of institutions have changed. For example, Norges Tekniske Højskole (NTH) became part of Norges teknisk-naturvitenskapelige universitet (NTNU), Universitetets Institut for Teoretisk Fysik (UITF) became Niels Bohr Institutet and Polyteknisk Læreanstalt became first Danmarks Tekniske Højskole (DTH) and later Danmarks Tekniske

Universitet (DTU). We have not attempted to ensure historical accuracy of the names at the time of the events being described, and we have also used a number of abbreviations, such as NBI for the Niels Bohr Institute, and CTH or Chalmers for Chalmers Tekniska Högskola.

The photographs are mainly from Nordita's archive, and the vast majority of them were taken by Christen Hansen, Nordita's house photographer for many decades. English translations of quotations were made by Helle Kiilerich.

Einar Gudmundsson, Helle Kiilerich, Ben Mottelson, and Christopher Pethick

Chapter 1

Nordita's Prehistory

Helle Kiilerich

The extensive and successful results of the cooperation between groups of scientists during World War II, especially within electronics, radar and nuclear power, created among politicians strong support for the natural sciences in all the western nations and the USSR. Professor Pekka Jauho gave a short description of how popular physics, including theoretical physics, was at that time : “It had great publicity and a positive response in the media. As an example it may be mentioned that when a group of Nordic government officials and a few scientists convened in Copenhagen to negotiate some details about Nordita’s charter, the headlines in the newspaper read ‘Nordic Brainclub Convenes in Copenhagen’. The belief in science as the remedy of world problems was still unshaken. Scientists were wise, not only in their own field but also in areas outside their competence. Their word was listened to, and believed.”¹

Financial support for experimental as well as theoretical physics was increasing and large accelerators were built in the USA, the USSR and the UK. At the same time, tight security surrounded work on how to harness nuclear energy, both for power reactors and weapons, but it was ineffective.

As early as 1945, members of the Swedish government at that time Secretary of Development and Education Tage Erlander (later prime minister of Sweden) and Secretary of Finance Ernst Wigforss were both very convinced of the importance of the natural sciences for the development of society and had a strong interest in basic research. Niels Bohr visited Tage Erlander already a few days after his return from England in August 1945, a meeting

¹Pekka A. O. Jauho ‘Raison d’être of Nordic co-operation in theoretical physics: a personal view’, Nordita preprint 87/62 (1987), ISSN 0106-2646.



The 'Nordic Brains Trust' outside the House of Honour at the Carlsberg Brewery, February 1956. In front of the steps, from left: C. Møller and H. Wergeland. First step: E. Laurila, S. Rozental, O. Klein, C. Thomsen, and G. Funke. Second step: E. Kinnunen, Niels Bohr, and S. Rosseland. Third step and behind: M. Jakobsson, I. Waller, P. Jauho, T. Sigurgeirsson, Aage Bohr, and E. Hylleraas (behind Niels Bohr). ©Janne Woldbye.

probably arranged via Torsten Gustafson, professor at Lund University. He told Erlander about his unsuccessful attempt to internationalize the knowledge of nuclear energy in 1944. He recommended that Sweden, based on its industrial development and large deposits of uranium, should form a committee for research in nuclear energy and start up research in nuclear energy for civilian use as soon as possible. The idea of a research institute formed by the universities of Lund and Copenhagen was also brought up.²

Probably as a result of this meeting, in the autumn of 1945 the Swedish government offered 100 million SEK to support the founding and operation of an international institute for theoretical and applied nuclear physics, with

²W. Christmas-Møller, 'Niels Bohr og atomvåbnet', (Vindrose, Copenhagen, 1985), ISBN 87-7456-219-3, pp. 89-90, 187.

Niels Bohr as the head. The institute should be open to researchers from all countries without exception and the leadership of the institute should be an international researcher with an extremely good reputation. In the words of Torsten Gustafson, “Wigforss and Erlander left it to me to investigate this proposal and I negotiated with Niels Bohr if he could accept to be the leader (as director or chairman of the Board) of this project. Niels Bohr had shown his interest in this project, but it was apparent there were some unspoken difficulties. Harald Bohr asked me to continue the discussions, saying it might be possible for Niels Bohr to find a passable way”.³

Later it became clear that among the difficulties was Winston Churchill’s views on nuclear matters. He believed that the technology of the nuclear bomb could be kept a secret for a long time and tried as far as possible to keep information away from unwanted countries like the USSR, even though they were allies at the time. Strict rules were issued by the countries with nuclear power to secure secrecy of information about this. Obviously the idea of an institute open for researchers from all countries would not be in tune with this strategy. Niels Bohr had already early in 1944 seen to it that President Roosevelt was informed of his opinion that the only way to prevent an arms race between nations would be to share information and together establish a neutral control of arms. He also brought up this question when he later visited Winston Churchill, but without success. In a meeting in September 1944, Churchill and Roosevelt decided not to follow the proposal of sharing information. Niels Bohr continued to work for an ‘open world’ and in 1950 he sent ‘The Open Letter’ to the UN, explaining the necessity to share information among nations in order to prevent mistrust and an international arms race.

Soon after the war followed the Cold War - the reaction from the western allies to Stalin’s policy in the East European countries which the Soviet army had liberated. Most of these countries then had a one party system and a communist government under Soviet hegemony.

After the war the USSR replaced Germany as the closest security risk for Denmark and it was believed to be in the Danish interest to avoid problems with this neighbour, whose intentions were regarded with some scepticism. Denmark (Prime Minister Hans Hedtoft) and the ‘militarily strong’ Sweden (Prime Minister Tage Erlander) worked for a Scandinavian defence union with Norway in order to form a neutral Nordic block and avoid a greater military alliance. It turned out to be impossible to unite Norway’s wish for orientation towards the West with Sweden’s wish to be neutral.

³T. Gustafson, ‘Bidrag til Norditas historia’, Nordita Preprint 86/24, T. Gustafson papers, Niels Bohr Archive.

After the breakdown of these negotiations, the Danish Social Democratic government decided to join the Atlantic Pact. The establishment of the Atlantic Pact, an international organization for political and military defence, was a continuation of the Dunkirk treaty from 1947 between France and the UK (which promised mutual assistance against military aggression and communism) and the Brussels treaty (The Western Union, WU) between France, the United Kingdom, Belgium, Luxembourg, and the Netherlands from 1948. Subsequently, the military role of WU was taken over by NATO, which also included the United States, Canada, Portugal, Italy, Norway, Denmark and Iceland. The purpose was to match the military strength of the USSR and this confirmed the division of Europe.

When, in 1954, the USSR asked to join NATO this was rejected by its members. After West Germany was accepted as a member of NATO in 1955, the USSR created the Warsaw Pact consisting of the East European nations under its hegemony as a barrier to what they saw as a threat from the West. In the Nordic area, Finland was neutral and had an agreement with the USSR securing their interest in this area. Sweden was also neutral and militarily very strong.⁴ This was the final establishment of the two sides in the Cold War, East and West, and it created great difficulties for East/West scientific cooperation for many years to come.

An interesting question is why Denmark, unlike the other Nordic countries, did not start research in nuclear power for civil purposes or establish a committee for nuclear research after the war, despite the fact that Niels Bohr possessed a deep knowledge of nuclear science and technology, including the Manhattan project that developed the first atomic bomb. The leaders of both the USA and UK mistrusted Niels Bohr due to his wish for an open world and his opinion that knowledge of nuclear weapons should be shared with their Soviet ally. As a result, the Americans, upon the termination of the war, demanded that Niels Bohr refrain from working on nuclear research following his return to Denmark.⁵ The restrictions imposed were so extensive that they also included necessary components for a nuclear programme for civilian use. The possibility that other research groups in Denmark would start up research in nuclear power without Niels Bohr was unthinkable; he was the leading scientist within atomic theory. Not until President Eisenhower launched the 'Atoms for Peace' programme in 1953 was nuclear research by Niels Bohr allowed. Niels Bohr himself took the restrictions im-

⁴Nikolaj Petersen and Christian Friis Bach, 'NATO' in 'Den Store Danske', Gyldendal, <https://denstoredanske.lex.dk/NATO>, retrieved 25 August 2020.

⁵Henrik Knudsen and Henry Nielsen, 'Uranbjerget. Om forsøgene på at finde og udnytte Grønlands uran fra 1944 til i dag', (Vandkunsten, Copenhagen, 2016), ISBN978-87-7695-414-7, pp. 29-51.

posed upon him by the Americans seriously. In a conversation with Torsten Gustafson about this he said, “If I distributed material which the American administration would consider as secret, then I would be shot if I came to New York”.³

CERN

All governments were interested in further exploring the potential of atomic energy, whether it was seen as a new energy resource for society or as a weapon to discourage enemies.⁶ In the Nordic area several governments established ‘atomic committees’ with members from the governments, industry and national scientists, (Sweden 1945, Norway 1947 and Denmark 1955), in order to investigate the possibilities.

In Europe no single country except for the UK had the economic and technical capacity to build large accelerators, and there was a fear that, if large facilities were created, the resources for smaller-scale science would be reduced. This led to the idea that several Western European countries could form a joint organization to work for a common solution.

One worry was the fact that after the war, many European physicists had gone to the USA, where research equipment and salaries were much better than in Europe. Odd Dahl, a Norwegian physicist, states in his memoirs that it was Pierre Auger who took the initiative to change this.⁷ Auger was a French nuclear physicist and the head of UNESCO’s department of mathematical and natural sciences from 1948 to 1959. Another important person was the Italian physicist Edoardo Amaldi, a very active and respected physicist, later Secretary-General of CERN 1952-1954. Auger invited central persons to a meeting in northern Italy in the autumn of 1950. The purpose was to find a strategy to stop the brain drain from Europe. Even a representative from the USA (Isidor Isaac Rabi) came to the meeting, as the USA did not see an advantage in a scientifically poor Europe. The result of the meeting was a proposal to establish an inter-European research laboratory for nuclear physics as good as the very best in the USA .

⁶Thomas Jonter has revealed that after the war both Norway and Sweden, like many other small countries, had planned to produce nuclear weapons. Norway stopped after joining NATO. In Sweden Tage Erlander made a compromise: Sweden would continue research in nuclear energy for civil purposes and the possible use of the technology to produce weapons based on Swedish uranium, officially called ‘protection research’. Thomas Jonter, ‘The Swedish Plans to Acquire Nuclear Weapons, 1965-1968: An Analysis of Technical Preparations’, *Science and Global Security* **18**, 61 (2010).

⁷Odd Dahl, ‘Trollmann og rundbrenner’, as told to Jan H. Landro, (Gyldendal, Oslo, 1981) p. 188. and CERN homepage: <https://CERN60.web.cern.ch/en/history>.

Landshövding (Provincial Governor) Malte Jacobsson, Chairman of the Swedish Atomic Committee at the time, describes the development of this project:⁸ “For some years European researchers in nuclear physics had discussed the founding of a common European organization for nuclear research at their meetings. In 1951 UNESCO took up this question and a European organization was formed, the European Council for Nuclear Research, or CERN, from the French version of the name, Conseil Européen pour la Recherche Nucléaire. Subsequently several meetings were held with different opinions about how to proceed. Some believed in building a common European laboratory, others, like the Dutch representative, Professor Hans A. Kramers, a physicist with an international scientific authority, Professor Niels Bohr and the Swedish delegates found that cooperation between the best-equipped European laboratories would be sufficient. Professor Kramers died suddenly in April 1952 and resistance to the idea of being content with cooperation among the existing European laboratories became stronger; even Professor Bohr and the Scandinavians hesitated. After months of heated discussion it was decided to settle for a new institute. As to the location of the institute, the choice was between Geneva and Copenhagen. Geneva was chosen and Copenhagen had to accept a general recommendation to be ‘the center for theoretical physics’.”

After the decision to build and run a common European accelerator, it was soon realized that theoretical physicists as well as experimental physicists were needed. At a meeting in 1951 it was decided to establish a European theoretical physics group to train young physicists from the European countries. This group was started in 1952 with a temporary base in Copenhagen at the University Institute of Theoretical Physics (UITF), which Niels Bohr headed. This institute had been one of the international centers for theoretical nuclear physics from the beginning, since Niels Bohr was one of the leading scientists in this field. The fellows were chosen by the individual countries, one from each country, and they received a fellowship from CERN during their 12-24 month stay in Copenhagen.

The decision about the geographical location of the project was a sensitive one and the discussions in this connection have been described by several of the people involved. Here I shall quote a few: According to Stefan Rozental, “For different reasons it could not be one of the big countries, and the choice finally stood between Denmark, Holland (the Netherlands) and Switzerland. Hans Kramers was a spokesman for Copenhagen as the place for CERN and this was also strongly supported by Norway and Swe-

⁸Malte Jacobsson, ‘Minnesbilder’, (Tryckindustri, Solna, 1964) pp. 175-76, translated by HK.

den. Niels Bohr made a tremendous effort to get support from the Danish government for this project.”⁹

Some countries found it unsafe to place CERN in Denmark as they believed this to be too close to the USSR. It turned out that even Sweden (the Foreign Ministry) found Copenhagen risky. Torsten Gustafson, recalls how he met with Prime Minister Tage Erlander and the foreign minister and told them about the wish to place CERN in Denmark. This was regarded as too dangerous by the foreign minister since, in the event of a conflict, the Soviets could occupy Denmark and make use of the world’s most powerful apparatus! T. Gustafson replied that no one could be stupid enough to believe that such an accelerator is dangerous, but the answer was “I can tell you the gang governing Russia now is the most ignorant bunch of devils that have ever governed such a big country”.¹⁰ Of course, Erlander and Gustafson found that, in such a doubtful case, the security of their country came before their wishes. Also the UK was strongly against location in Denmark because Denmark was too vulnerable to the Soviet Union.¹¹ Arguments that the laboratory would have no military significance were of no avail.

Others found the climate poor and Denmark to be on the outskirts of Europe.¹⁰ France insisted that the project should be placed in a French speaking environment and finally in October 1952 at a meeting of CERN, Geneva, was chosen.⁹ This was naturally a disappointment for Niels Bohr and all the people who had worked for a Copenhagen solution.

The preparations to establish the common accelerator project proceeded with a group of European countries. The final goal was to form a convention, containing the rules of governance, economic support and administration. Based on this convention each country could decide whether or not to participate.¹²

Before one could start there had to be a referendum in the canton of Geneva, where it was planned to locate CERN. After the war the word ‘nuclear’ was associated with danger and the outcome of this referendum was not a foregone conclusion, but a majority voted in favour of placing CERN there.¹³ It took some time to construct the buildings for CERN.

⁹ Stefan Rozental, ‘NB. Erindringer om Niels Bohr’, (Gyldendal, Copenhagen, 1985), ISBN 87-00-93874-2, p. 111.

¹⁰T. Gustafson, ‘Bidrag til Norditas historia’, draft of Nordita Preprint 86/24, T. Gustafson papers, Niels Bohr Archive.

¹¹J. Chadwick letter to Niels Bohr, 2 Oct. 1952.

¹²Later it became important to clarify whether a decision was made in the temporary or permanent organization and the official name of the permanent organization became ‘Organisation Européen pour la Recherche Nucléaire’, but the abbreviation CERN was retained since it was so well known. Ref. 9, p. 116.

¹³Ref. 9, p. 112.

Work in Geneva began in some temporary barracks at the airport. However, the European theoretical physics group continued to work in Copenhagen until the new buildings were finished in 1957, when the group moved to Geneva.

Nordita

Cooperation among Nordic physicists, especially within theoretical physics, had developed over many years of contact and meetings like the Scandinavian meetings of scientists. The first of these meetings took place in 1839 in Gothenburg, initiated by the Norwegian doctor of medicine Chr. A. Egeberg, followed by meetings in Copenhagen in 1840, arranged by the Danish scientist H. C. Ørsted, Stockholm in 1842, arranged by the Swedish chemist Jöns J. Berzelius and Christiania (Oslo) in 1844, arranged by the Norwegian geophysicist Christopher Hansteen. These meetings were extremely important in building up personal contact among researchers in the Nordic area. The meetings continued for almost 100 years, the last one taking place in Helsinki in 1937.¹⁴

Niels Bohr (1885-1962) became professor of theoretical physics at Copenhagen University in 1916. He was considered worldwide as one of the leading scientists in theoretical atomic physics and received the Nobel prize in 1922 for his work on the structure and radiation of atoms.

In 1921 Copenhagen University established The University Institute for Theoretical Physics (UITF), from 1965 The Niels Bohr Institute, where Niels Bohr could work with his colleagues. These included physicists from other international universities and research institutes, especially Europeans, working for shorter or longer periods at the institute. From the beginning many Nordic physicists were part of the international group of researchers that gathered in Copenhagen around Niels Bohr, who played a fundamental role in the creation of the new atomic physics in the 1920s and the beginning of the 1930s. Among the Nordic researchers were Christian Møller from Denmark, Svein Rosseland, Johan Holtsmark, Egil Hylleraas and Harald Wergeland from Norway, Jarl Wasastjerna, from Finland and Oskar Klein, Ivar Waller, Torsten Gustafsson, Nils Svartholm and Lamék Hulthén from Sweden. Later Thorbjörn Sigurgeirsson from Iceland also joined the group.

During World War II, personal contact was limited as travel was difficult if not impossible. Denmark was occupied by the Germans from 1940 to 1945 and Niels Bohr had to escape to Sweden in 1943 with his family. Niels Bohr

¹⁴Illustreret norsk literaturhistorie 'Videnskabernes literatur i det nittende aarhundrede', <http://runeberg.org/ilnolihi/4/0218.html> .

and his son Aage continued to the UK and later the USA as members of the British contingent in the Manhattan project while the rest of the family stayed in Sweden. The whole family returned to Denmark in 1945.

The establishment of Nordita was closely connected to the creation of CERN. The idea of having a Nordic Institute for Theoretical Atomic Physics without direct connection to applied research continued to be an issue for Nordic physicists after the war. In Copenhagen Niels Bohr and other physicists had started a discussion about the possibility of forming a Nordic group for theoretical atomic physics already before 1953 (when the decision about the future location of CERN was made). As members of CERN, both Norway and Sweden had fellows for training at CERN's theory group in Copenhagen, and both countries wanted in the future to have their physicists given this theoretical training. Since this was regarded as a Nordic cooperation issue, Finland and Iceland were invited to take part in the discussions and several meetings were held. The University of Lund, where Torsten Gustafson was professor in theoretical physics, was in the early 1950s an important refuge for Finnish theoretical physicists like Karl-Gustav Fogel, Pekka Jauho and K. V. Laurikainen. Pekka Jauho spent time in Lund in 1955 and was close to Torsten Gustafson, who brought up the plan for a Nordic Institute and the wish to include Finland. At that time Finland had just become a member of the Nordic Council. Pekka Jauho informed the Finnish Minister of Commerce and Industry Aarre Simonen, who at once decided that Finland should join in the planning of the institute. Pekka Jauho kept contact with the Finnish ministries about the development in the plans, and was seriously involved in the creation of Nordita as well as the future development of Nordita as he served as one of the Finnish members of the Nordita Board from its creation in 1957 to 1989.¹⁵

Niels Bohr was very active and enthusiastic about the idea and took part in the negotiations. One important meeting took place on January 16, 1952 in Gothenburg, where Niels Bohr met with the chairman of the Swedish Commission of Atomic Energy, Malte Jacobsson, who strongly supported the project. Also present was Professor Torsten Gustafson, who was a strong supporter of the project. He had worked at the institute in Copenhagen and was a friend of Niels Bohr. In addition, Torsten Gustafson had easy access to the prime minister of Sweden at that time, Tage Erlander, as they had studied physics together at Lund University and had been friends since then. For many years Torsten Gustafson was an adviser to Tage Erlander

¹⁵Christofer Cronström, 'NORDITA 50 år - forskningsinstitutets uppkomst och betydelse', *Reflexer* nr 10, p. 42 - 49, Fysikersamfundet i Finland - Suomen fyysikkojen seura, ed. Kristoffer Meinander. Yliopistopaino, Helsingfors, 2008. ISBN: 978-952-92-3958-0. Available at https://nordita.org/docs/nordita_50_year_cronstrom.pdf.

on scientific and educational questions.

Another meeting in Gothenburg was arranged on February 17, 1953, this time with Danish, Swedish and Norwegian physicists. At this meeting it was decided to put the proposal in writing.

The day after this meeting Niels Bohr received a letter from Malte Jacobsson dated February 18. After the meeting, Jacobsson had thought about what was agreed upon and found there were several unclear points. Referring to what he and Niels Bohr had agreed to in Rome, (where they both participated in a meeting about CERN) “to take it easy with the theoretical group, and work to secure a Nordic theoretical institute at an estimated cost of 400,000 kr.”¹⁶ he found that the possible consequences of the meeting’s decision had not been duly considered. In his opinion, if CERN were to retain and support the theory group in Copenhagen for some more years, this group would fulfil the aim of a theoretical institute, namely to educate young physicists including Nordic ones. With possible additional support from the Nordic countries it would be possible to have an adequate number of Nordic fellows. To start the funding of a Nordic institute at the planned cost now, with the same purpose as CERN’s theory group, would just be a waste and definitely move CERN from Copenhagen, which in his opinion would be very unfortunate. Jacobsson asked Niels Bohr to take up this matter with his friend and colleague Jakob Nielsen, a mathematics professor at the Polyteknisk Læreanstalt (now DTU), who was involved in international cooperation through UNESCO and let Jacobsson know his opinion as soon as possible.

Niels Bohr answered Jacobsson’s letter on February 20. He agreed that the Nordic project should in no way have consequences for the CERN cooperation or the theory group in Copenhagen. It would be advisable to get the best out of the situation and be very aware not to do things in a way that could have unwanted consequences. He also agreed that Nordic cooperation within theoretical physics should start up in a modest way.

Nevertheless, as decided at the meeting in Gothenburg, a memorandum was written by Niels Bohr, Torsten Gustafson, Egil Hylleraas (Norway) and Stefan Rozental on February 25, 1953. This memorandum contained all the elements which were later to form the backbone of Nordita. The memorandum started by describing the importance of theoretical physics in explaining results from experiments and suggesting possible new experiments. The institute would offer Nordic physicists the possibility of visiting the institute for shorter or longer periods. Physicists from other countries should also be invited. The institute should be governed by a board appointed by the

¹⁶M. Jakobsson, letter to Niels Bohr, February 18, 1953.



A meeting between Niels Bohr, Malte Jacobsson and Torsten Gustafson at Jacobsson's home in Gothenburg, 16 January 1952.

governments, three members each from Denmark and Norway, and four from Sweden. At this time neither Finland nor Iceland were officially part of the plan. The board would decide the governing rules for the institute and select the fellows, the long-term visitors, and the research and administrative staff at the institute. The annual budget was now estimated at DKK 500,000 and its disposition should be decided by the board. The board would meet once per year but decisions could also be taken by correspondence. The daily running of the institute would be done by a head of the institute in cooperation with the scientific staff at the institute. Denmark would also contribute by providing housing for the institute and its maintenance.

On February 25, a copy of the memorandum was sent to Malte Jacobsson and T. Gustafson, who had had to leave Copenhagen before the draft was typed in order to participate in a meeting in Stockholm.

On March 2, Niels Bohr received a long letter of two full pages from the secretary of the Swedish Atomic Committee, Gösta W. Funke, explaining in detail the outcome of a meeting Funke and Jacobsson, as representatives of the drafters of the memorandum, had had with members of the government, three ministers, Tage Erlander (Prime Minister), Östen Undén (Foreign Min-

ister) and Ivar Persson (Minister of Education), together with the latter's head of administration, Edenman. At the meeting, they discussed the possibility of presenting at that year's session of the parliament a proposal for a Nordic institute within theoretical atomic research, financed separately, and for obtaining support in principle from the parliament for this. The attitude of the Swedish Atomic Committee was positive.

However, it turned out that the Swedish government was unwilling to propose participating in the CERN project and at the same time make a decision in principle about a Nordic institute for theoretical nuclear research. The government found that the CERN decision would be fairly easy as the parliament was psychologically well prepared. As for the Nordic institute, such a proposal should be sent beforehand to other authorities for comments and should be very well prepared. The deadline for proposals for parliament was only three weeks away and since a well prepared document could not be ready in time, there was a risk of a total rejection. One member of the government (Undén) was worried that Sweden would be short of good theoretical physicists as some would go to CERN and now maybe also Copenhagen. This worry might reflect his 14 years as Rector of Uppsala University. The argument that, on the contrary, the Copenhagen institute would improve the quality of Swedish theoretical researchers was of no avail. The government found it might be much easier to include the Nordic institute in the contribution to the national Swedish Atomic Committee.

The letter finally proposed that Niels Bohr write to the Swedish Atomic Committee, explaining how the Swedish decision would affect the Danish possibilities to establish accommodation for the coming Nordic institute. Once this had been explained, the Atomic Committee might again look at the proposal and maybe promise to support a Nordic institute in one way or another. A guarantee of Swedish participation according to the plans could not be possible before the handling of the petition of the Swedish Atomic Committee in October. Another detail was mentioned in the letter, namely whether the institute should be named 'Nordiskt institut för teoretisk kärnforskning' in order to underline it was theoretical research.

Niels Bohr replied on March 9, with a letter to Funke's private address, expressing the understanding that, as Jacobsson and Gustafson had envisioned, it was not possible to further the matter of a Nordic institute. He added that it would now be possible for the Danish and Norwegian parties to prepare a better version.

As for the name, Niels Bohr did not agree to 'kerne', as this in Danish is too close to the pip of an apple, but suggested 'Nordisk Institut for Atomteori' as a possibility. He was convinced that a solution to such minor questions would be found easily. Bohr did not take up the suggestion that he write

to the Swedish Atomic Committee to inform it about the negative effect concerning a new building for a Nordic institute.

Reading these letters it seems to me as if Niels Bohr overlooks the warning given by Jacobsson in his letter of February 18, the day after the Gothenburg meeting. Jacobsson was the head of the Board of the Atomic Committee and I believe that after he received the detailed plans for a Nordic Institute dated February 25, he asks Funke to explain in detail that the plan for a Nordic institute has to wait if one wants the project to be realized. At the same time, it appears that Niels Bohr had been told earlier that a proposal for a Nordic institute could be handled successfully at that time.

A possibility for further support to the theory group in Copenhagen came when Werner Heisenberg, in a letter to Niels Bohr at the beginning of March 1953, related that the German Forschungsgemeinschaft had proposed to CERN that 10% of its budget should be used for European collaboration outside Geneva as long as the construction was not finished. Heisenberg would like to be informed if Denmark or Sweden had specific items in connection with the coming meeting in Rome.

So far the CERN theoretical physics group was working in Copenhagen, awaiting the building of the new institute in Geneva, and there was a wish but no rush to establish the Nordic institute. It was therefore a surprise to Niels Bohr and other participants in the January meeting to learn from Edoardo Amaldi's latest Weekly Report about a letter dated March 5, from the Norwegian physicist Odd Dahl to Amaldi, at that time Secretary-General of CERN, saying that "Scandinavia,¹⁷ Iceland and Finland wish to establish a Scandinavian Theoretical Institute in Copenhagen to function with Scandinavian money and independent of CERN. Bohr will give detailed information about this plan at the Executive Group meeting". This information created a disturbance. There was the letter from Funke, explaining how uncertain the plan for a Nordic institute seemed, and now there could be problems with CERN, to say nothing of the problem if the Nordic plan were to be made public before it was ready. This could be the end of the plan.

For a time it was thought that Hylleraas had informed Dahl, maybe even given him the written memorandum about the Nordic institute. I believe that in order to investigate this, Stefan Rozental wrote to Hylleraas on March 10, telling him about Heisenberg's information of a future possible contribution from the CERN budget and that Niels Bohr would respond to a letter (from Hylleraas about a physics question) within a few days, and finally quoting Dahl's report about the Nordic institute in the CERN 'Weekly Report', mentioning Niels Bohr's intention to write to Amaldi and

¹⁷i.e., Denmark, Norway and Sweden

underline the independence of the Scandinavian plan from CERN. The letter ends “Should he do this he will send you a copy”.

It seems that a phone call was made, since, in a letter of March 11, Hylleraas expresses his gratitude for a phone conversation. He finds it useful to be informed very quickly about things under way. He also relates that the idea of a Nordic institute was brought up at a meeting in the Norwegian Atomic Committee while he himself was in Copenhagen, preparing the written proposal about the Nordic institute together with the other members of this group. The Norwegian professor J. P. Holtsmark, who also participated in the Gothenburg meeting, had informed the Norwegian Atomic Committee about the plans. The committee, as far as Hylleraas knows, was positive about the idea of a Nordic institute, but no one had imagined the idea would be ready for an announcement at the CERN meeting.

This information, probably also given over the phone, convinced Stefan Rozental that the information by Dahl was only based on an oral report, not the written document. Niels Bohr wrote a letter to Amaldi, dated March 10, first mentioning the programme for the coming Council meeting and problems to be discussed in connection with the transition period, then referring to the latest Weekly Report and Dahl’s letter informing about the wish to establish a Scandinavian theoretical institute in Copenhagen: “these plans, which are in the first stage of preparation, form a part of general endeavours to tighten the connection between the Scandinavian countries in various domains of economic, social and cultural life. I was, admittedly, somewhat surprised that Dahl, without asking me, has announced that I would account for such Scandinavian plans at the meeting of the Executive Group, but I am, of course, with pleasure ready to do so.” A copy of the letter to Amaldi was at once sent to the other participants in the January meeting, and enclosed in a letter to Malte Jacobsson, assuring him that he (Niels Bohr) did not intend to disclose details in the plan, which was still being discussed internally. Copies of the letter to Jacobsson, of Bohr’s letter to Amaldi, and of Amaldi’s Weekly Report were also sent to Hannes Alfvén, Funke, Gustafson and Waller. S. Rozental wrote a letter to Hylleraas on 12 March and enclosed a copy of the letter to Amaldi. At the same time he asked Hylleraas to show the letters of the previous few days to Holtsmark, “as the information we send to you is also for Professor Holtsmark, even if not addressed to him”. He added: “We thought Dahl’s information to Amaldi was based on the statement made in Copenhagen during your visit (after the February meeting), but it now seems that the basis has been even slighter”. It is obvious that the letter from Niels Bohr to Amaldi was not written before it was certain that the information to Amaldi was not based upon the written proposal, but only on oral information. It is also clear that

nobody wanted to rock the boat.

One may wonder why Odd Dahl informed Amaldi about the preliminary Nordic plan so rapidly and without consulting Niels Bohr. Since the spring of 1951, Dahl had assisted in designing for CERN an upscaled version of the Cosmotron accelerator at Brookhaven National Laboratory in the USA. In the summer of 1952 he became leader of the Proton Synchrotron Group. Dahl knew Amaldi because they both had worked at the Carnegie Institute in the USA in the late 1920s and the 1930s, and from 1952 Amaldi had been his employer, since he was Secretary General of CERN in the interim period 1952-54.

One explanation could be old friendship, another might be that, in the same letter to Amaldi, Dahl says that he is preparing a budget for his group to be ready for the Executive Group meeting. There seem to be many uncertainties and difficulties - probably meaning expenses - and then it is good news to mention possible savings. Or, according to a remark from Niels Bohr in a discussion about Nordic cooperation within nuclear physics with M. Jacobsson and T. Gustafson, that contrary to Denmark and Sweden there exists in Norway a difference of the goals for nuclear research between engineers and theoretical scientists. I do not believe he had any wish to harm Niels Bohr. As to the question of why Amaldi published the letter, the reason could be to make known that Copenhagen probably would get an institute for theoretical physics after all, knowing the disappointment that Copenhagen was not selected for CERN.

The question of a Nordic institute did not return to the agenda until after the decision of the approximate year for moving the CERN theory group to Geneva was made in 1955. The year for the move was planned to be 1957.

In 1955 while attending the meeting of the Nordic Council in Stockholm, the Danish prime minister, Hans Hedtoft, was found dead at his hotel. He had been a very enthusiastic supporter of Nordic collaboration and one of the major players in the creation of the Nordic Council in 1952.¹⁸ Hans Hedtoft's successor was H. C. Hansen. Both Erlander and H. C. Hansen, who was both prime minister and foreign minister, were eager to strengthen Nordic cooperation.

Torsten Gustafson had a meeting with Erlander on September 1, 1955. Tage Erlander had in confidence been asked by H. C. Hansen if he knew of an internordic project that could be presented to the Nordic Council at its meeting in January 1956 and carried through quickly. If possible, suggestions should be discussed at the next meeting of the Nordic ministers,

¹⁸Finland had been involved in the planning of Nordita but did not join the Nordic Council until 1955 at a time when this could be done without provoking the USSR.

on September 8, or at the latest at their meeting after the middle of October. Torsten Gustafson said that already at the September meeting one could announce that Niels Bohr was considering some proposals for a Nordic project, and told Erlander about the plans for a Nordic institute for theoretical atomic physics, that Bohr had earlier discussed with Malte Jacobsson and Torsten Gustafson. Tage Erlander was worried whether an institute like that could be established at that time, as Sweden was already participating in CERN in Geneva. Gustafson understood the concern but explained that CERN would not be able to educate as many researchers as were needed, and not at the early stages one wanted. He also mentioned discussions he had had with Pauli and Heisenberg about an institute in Copenhagen, and Heisenberg agreed that a first class institute would always be the *raison d'être*.

This may be seen as the right project at the right time. A project of considerable interest and status to honour the late Hans Hedtoft and the Nordic collaboration he had worked hard for. The meeting of the Nordic council in 1955 in Stockholm had not been remarkable in any way.

At a meeting in Copenhagen on 28 September 1955 between Niels Bohr, Malte Jacobsson and Torsten Gustafson, the question of Nordic cooperation within atomic research, both theoretical as well as technical, was discussed. Niels Bohr reported that according to Homi Bhabha,¹⁹ who had just returned from a visit to the Soviet Union, the Soviets educated with great intensity physicists and engineers, and their newest accelerator was more powerful than the American ones. Niels Bohr predicted that within a few years there would be two big technical and scientific centers, the Soviet Union and the USA. In his opinion, ‘secrecy madness’²⁰ had ‘disturbed’ the assessment of the Soviet Union.

Niels Bohr was in favor of a broad Nordic cooperation, theoretical as well as technical. Later in the discussion he emphasized that in his opinion the Nordic cooperation was not political, but rather three small countries helping each other with knowledge, as if they were a single, larger country with larger resources.

Malte Jacobsson asked if Denmark in connection with the research in nuclear energy would establish an industrial consortium²¹. According to Niels Bohr both England and the USA had offered cooperation and assistance in building reactors in Denmark. In this connection a Danish atomic energy

¹⁹Homi J. Bhabha, Indian nuclear physicist, (1909-1966) founding director and professor of physics at the Tata Institute for Fundamental Research. See https://en.wikipedia.org/wiki/Homi_J._Bhabha.

²⁰In Danish, ‘hemmelighedsraseri’.

²¹In Swedish, ‘bolag’.

commission, with experienced physicists and members from industry, power plants, shipyards etc. was formed. The administration was a matter for the state, as the state would be responsible for the uranium and other material delivered from the UK and the USA. A bill was ready for approval by the parliament; it would secure great autonomy for the commission and the establishing of a research centre for atomic energy could begin. The Danish laboratory for research on nuclear power at Risø was founded only months later.

Now the establishment of the Nordic theoretical institute was brought up. The CERN theory group had been working mostly in field theory and the theory of nuclei, but Niels Bohr wished to extend the topics studied as well as the size of the institute, as soon as possible. Now was the time for Sweden and Norway to decide if they wanted to realize the plans for a Nordic institute for theoretical atomic physics in Copenhagen. If his goals could not be achieved through Nordic cooperation, he would contact foundations personally.

The Danish government, like the Swedish one, was interested in this cooperative Nordic project. In both Sweden and Denmark physicists and engineers in the area of nuclear physics worked together, and the Atomic Committee in Sweden had supported both. However, in Norway there was tension between the two groups.

During this conversation Malte Jacobsson suggested forwarding the idea to the Nordic Council. Niels Bohr at once said he would talk to Svenningsen (the director of the Danish Foreign Ministry) about this, as the Nordic foreign ministers always met before the meetings in the Nordic Council. Niels Bohr would point out that one should stress the goal of the Nordic Council to express hope to the Nordic populations. One could tell the politicians, there is a hope about such a Nordic organized cooperation, it would be up to Sweden and Norway to express their wish for Copenhagen as the place for the institute, if this was still their wish, the Danish minister of state H. C. Hansen would be told.²² Malte Jacobsson asked Torsten Gustafson to draft a memorandum and he would contact Tage Erlander before the meeting of the Nordic Council on October 21. We know from a letter from Gustafson to Jacobsson dated 14 October that Tage Erlander asked to receive the protocol sooner, as he was to meet H. C. Hansen (from Denmark) and Einar Gerhardsen (from Norway) a few days before October 21.

The idea to forward the plans for a Nordic institute through the Nordic Council was important in many ways. The plans would be judged by an independent Nordic committee and thus ensured legitimacy - it was not

²²T. Gustafson papers, Note 12.

only the Nordic physicists wanting an institute for their research but an important cooperative project to benefit the Nordic societies. Also, since this would be a cooperative Nordic project within education, there would be no conflict with participation in CERN.

In 1955 and 1956 a number of meetings of Nordic physicists and representatives of the Nordic research councils were arranged. At an internordic meeting, with participants from Denmark, Finland, Norway and Sweden, held on November 28, 1955, at the Swedish Atomic Committee in Stockholm, Torsten Gustafson, presented the memorandum about the funding of a Nordic institute for theoretical atomic physics. The memorandum was discussed and revealed two different groups, one in favor of an institute, the other in favour of an advisory committee to support the work in theoretical physics at the universities.

For the next internordic meeting January 20-21, 1956, in Copenhagen, Prof. Harald Wergeland, Trondheim, had written a statement about the importance of an institute as support to the small and isolated theory groups at the universities. He stated that even the big countries had difficulties in teaching students in this new area of physics. In this connection he mentioned a number of 'Free Institutes' for advanced studies established in the USA and Europe, e.g. The Institute for Advanced Study in Princeton, where excellent physicists like A. Einstein had good working conditions. The institute arranged schools for graduates and played an important role in American physics. Another example was The Dublin Institute for Advanced Studies, with Heitler and Schrödinger. These institutes with fewer formalities and obligations than the universities and an environment of excellent researchers and research students created a very fruitful atmosphere with good results in scientific development. Furthermore these institutes were not expensive compared with other physics establishments, but were very successful in creating new knowledge. Wergeland also included CERN as one of these new institutes, but doubted whether CERN could fulfil the wish for theoretical education of as many Nordic researchers as were needed. Wergeland regarded the establishment of an institute in Copenhagen, where one already had an international center for theoretical physics, as an excellent opportunity to create a Nordic institute in Copenhagen. This view was supported by the representatives from Finland and Iceland, which two countries had now officially joined the plan.

A majority of the participants supported the funding of an institute. As for Norway, a minority of the Norwegians were not sure that an institute supported by the five Nordic countries would be the right solution. Actually Svein Rosseland had written to Niels Bohr some time before the meeting to tell him that he had been informed, via a phone call from the minister

of education, that the idea of an institute would not be accepted. Only a construction of a Nordic advisory commission for atomic physics with a representative from each Nordic country under the auspices of the Nordic Council, like the Nordic marine-biological stations, would be accepted. This commission could subsequently propose the foundation of an institute.

At the meeting it was decided to ask the national atomic organisations to contact their local governments in order to establish a Nordic committee for atomic physics cooperation under the Nordic Council to look into ways of furthering Nordic cooperation in atomic research and the peaceful use of nuclear energy. This request was also sent to the Nordic Council before their meeting in January and February 1956 in Copenhagen. The committee was established and asked to work as quickly as possible.

The information from Rosseland was important, and Torsten Gustafson was informed. He found the situation for the Nordic institute insecure. As he says, these kinds of plans normally crash on the way. The alternatives were a Nordic institute without Norway or an international institute. But as he put it, now the Nordic prime ministers went into action, meaning the decision to establish a Nordic institute for theoretical physics was now in the hands of the politicians and the most powerful ones.

Torsten Gustafson wrote at once to Tage Erlander, informing him about the attitude of the Norwegian government. Tage Erlander wrote back that he had had discussions with the Norwegian government about Nordic cooperation within nuclear research and their considerations in this connection, but he was sure things would work out as E. Gerhardsen (prime minister of Norway) had hinted that the Norwegian government would send the minister of education (B. Bergersen) to attend the meeting in the Nordic cooperation committee for atomic research, and thus underline the importance of this cooperation.

Real negotiations started when, at their meeting in January 1956, the Nordic Council decided to take up the proposal from the Nordic committee for atomic cooperation in its finance committee. As mentioned before, Norway had been reluctant to engage fully in this cooperation. T. Gustafsson was later told that Malte Jacobsson, who knew the Norwegian prime minister Einar Gerhardsen from the time he was an official in Gothenburg and Gerhardsen had a similar position in Oslo, had contacted Gerhardsen and in a meeting with him and the King of Norway told him how important it was that Norway became part of the institute. Tage Erlander, too, arranged a meeting with Gerhardsen and new negotiations led the Norwegian government to participate in the project. It was obvious that this change had to do with the talk with Malte Jacobsson and between the two prime ministers. When Torsten Gustafson accidentally met the two prime ministers he asked

them about this. Gerhardsen said, “In Norway we have two ways in relating to the world around us, one, look west to England and the USA, this has been enforced during the war, the other relies mostly upon the contacts to the other Scandinavian countries”. He himself had strong contacts to Sweden and the Social Democratic Party there and in Denmark and, when his party had obtained the parliamentary majority, he had at once seen to it that Norway joined the Nordic Council.³ It should also be mentioned that after a period out of office Gerhardsen returned as prime minister in January 1956, and as such had a strong influence on the Norwegian position.

The recommendations from the Nordic committee for atomic cooperation was handled on February 21, 1957 at the meeting of the Nordic Council in Helsinki.²³ The committee had followed a sensible Finnish proposal and changed the project into two, a theoretical one and a technical one.

It was decided unanimously to follow the recommendations of the committee and launch a Nordic institute for theoretical atomic physics in Copenhagen, and the appointment of a board to run the institute, which would be a forum for Nordic cooperation within theoretical atomic physics. The experimental part was to create a Nordic contact committee to deal with questions regarding nuclear energy and closely follow the planning and activity within that area and promote the possibilities for Nordic cooperation which might turn up, including cooperation in the area of reactors.

During the following negotiations, Niels Bohr was an important participant. He was very enthusiastic and convincing in his argumentation and found solutions when needed. Finally the preliminary statutes of the institute were approved by the governments of the five Nordic countries and Nordita could start its activities on October 1, 1957.

²³The minutes from the meeting in the economic committee where the proposal from the Atomic Committee was dealt with before the final decision in the Nordic Council shows that besides the 17 members of the economic committee another seven important persons participated: Minister of Finance Viggo Kampmann, Denmark; Minister of Fisheries Christian Christiansen, Denmark; Minister of Trade and Industry Kauna Klemolaa, Finland; Prime Minister Einar Gerhardsen, Norway; Minister of Foreign Affairs Halvard Lange, Norway; Minister of Industry, Gustav Sjaastad, Norway; Under-Secretary of State Gunnar Lange, Sweden.

Chapter 2

Nordita in Copenhagen: An Overview

Helle Kiilerich

Introduction

After the Nordic Council had recommended the establishment of a Nordic Institute for Theoretical Atomic Physics at its meeting in February 1957, and the Nordic governments and parliaments agreed to this proposal, the institute began operations on 1 October 1957.

According to the preliminary statutes, the main purpose of Nordita was to further cooperation among the Nordic countries within fundamental theoretical research in atomic physics.¹ The work was to be made public and accessible to everyone. Nordita would not engage in activities serving military goals. This point was taken seriously and for many years Nordita did not provide support for the NATO scientific schools in Norway, except by at most covering expenses for a speaker or participant.

The purpose of the institute was to be fulfilled through the following activities: a research programme in theoretical atomic physics; a hub where Nordic researchers could carry out research and meet colleagues from the Nordic area and from abroad; education of young Nordic physicists within theoretical atomic physics; the furthering of Nordic scientific cooperation by visits to other Nordic institutes by Nordic and international researchers;

¹Since the 1950s the use of the term ‘atomic physics’ has become more specialized, and today it does not generally include what we would refer to as ‘nuclear physics’.

and the planning and organization of symposia and conferences in the Nordic countries.

The Danish State provided the necessary premises and their running costs, e.g., for cleaning, heating and electricity. The operating expenses were covered by contributions from the participating states. Until 1973 the contributions were in proportion to the population of each country. The Board proposed a budget for the coming and following years and sent this to the Danish ministry of education. The Danish government, after having consulted the other states, informed Nordita whether the budget was approved or had to be changed and any remarks in this connection. From 1973 the Nordic Council of Ministers took care of the budget proposals and related decisions. This was part of an agreement to make a collective evaluation of all the Nordic cooperation projects supported through the Nordic Council.

For the first seven years Nordita was located in the C-building at the University Institute for Theoretical Physics (later the Niels Bohr Institute), with some offices for fellows and staff in other parts of the building complex. Nordita took over Blegdamsvej 15 in 1964, the most westerly building in the complex. The University's Institute of Mathematics, where Harald Bohr had been professor, had been housed there but had moved to the H. C. Ørsted Institute after it was built.

The institute was managed by an interim board of physicists, mainly theorists, appointed by the governments of the five countries. The institute was headed by a director appointed by the Board. The Board passed resolutions on the operation of the organization, including questions pertaining to the appointment of staff and the selection of research fellows. Moreover, the draft statutes, prepared by a special committee, were discussed and approved by the Board in June 1958. Members of the interim Board were:

From Denmark	From Finland
Professor Niels Bohr (elected chairman)	Professor Pekka Jauho
Professor Christian Møller	Professor Rolf Nevanlinna
Dr. Stefan Rozental	
Professor Aage Bohr (deputy)	From Iceland
Professor Jørgen Bøggild (deputy)	Professor Thorbjörn Sigurgeirsson
From Norway	From Sweden
Professor Egil Hylleraas	Professor Torsten Gustafson
Professor Svein Rosseland	(vice-chairman)
Professor Harald Wergeland	Professor Oskar Klein
Professor Johan Holtsmark (deputy)	Professor Ivar Waller

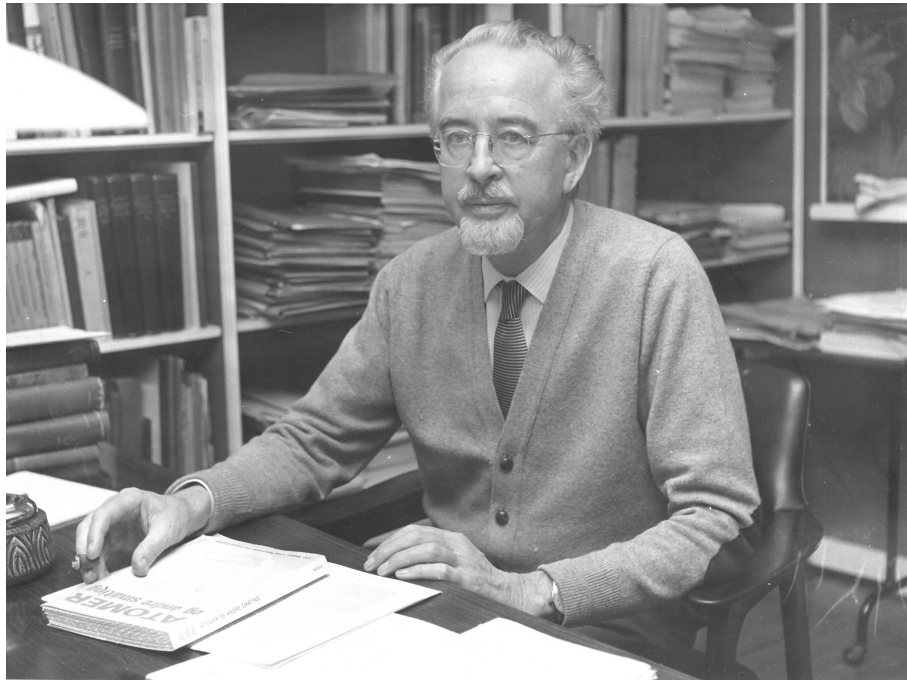
Leo Nielsen, assistant head of section in the Ministry of Finance (Denmark), acted as secretary to the Board. The auditor of accounts was Jørgen Bredsdorff, head of section in the Government Audit Department (Denmark). Dr. Gösta Funke, secretary-general of Atomkommittén (Sweden), accompanied the Swedish group as adviser.



The first meeting of the Nordita Board 4 October 1957. Front row, from left to right: S. Rozental, I. Waller, J. P. Holtsmark, P. Jauho, Niels Bohr, T. Gustafson, J. Bøggild, G. W. Funke, Leo Nielsen, and E. Hylleraas.

In connection with the practical management of the new institute the interim Board decided at its meeting in June 1957 to adapt the rules used and the experience gained in managing the CERN study group. This turned out to be very useful, as the CERN regulations were designed for the running and recruitment of an international institute.

As for the scientific personnel, at its meeting in June 1957 the Board decided to ask Professor C. Møller, who had acted as Division Director for the CERN study group, to act as director for Nordita in the interim period and asked Aage Bohr and Stefan Rozental, who had both worked as Assistant Division Directors at the CERN study group, to assist the director by continuing their work, following the rules and procedures used at the



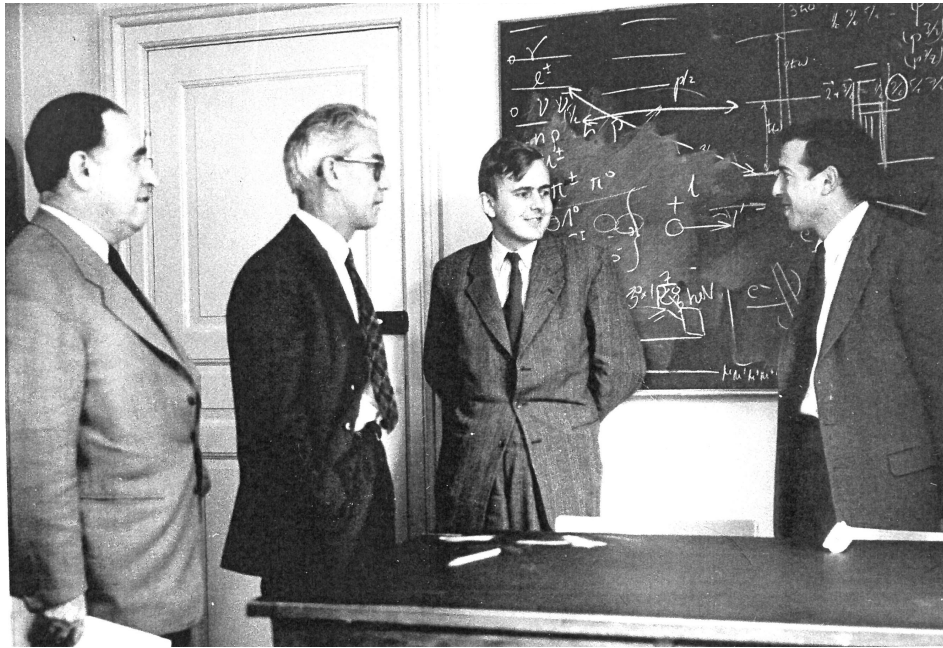
Christian Møller.

study group. All three held university positions and the work connected with Nordita was part-time, for which they received compensation accordingly.

At a preliminary meeting in May 1957 Dr. Ben Mottelson and Dr. Gunnar Källén, both staff members of the CERN study group, were invited to take part in the management of the Nordic institute during the interim period of 12 months and they accepted. About one year later, Källén accepted a position as professor at Lund University and for about 6 months following his appointment in Lund he spent 50 percent of his time in Copenhagen. After that he concentrated on his professorship in Lund. A proposal to start negotiations with Ben Mottelson to take up a professorship at the newly created Nordita was agreed to by the Board in 1957.

For the first six months of Nordita's operation, Christian Møller had been invited as a visiting professor in the USA, and Torsten Gustafson was asked to replace him as director during this period. Gustafson successfully negotiated the conditions for hiring Ben Mottelson. This was not trivial as he had offers from other interested parties abroad, and a special arrangement had to be made. Both Niels Bohr and Christian Møller were in the USA during the negotiations and Torsten Gustafson kept both of them well informed.

The Board also decided to make an offer to Professor Léon Rosenfeld,



Stefan Rozental, Torsten Gustafson, Gunnar Källén and Ben Mottelson (1957).

University of Manchester. At a meeting in October 1957 the Board approved the conditions in connection with the hiring. As chairman of the Board, Professor Niels Bohr wrote the letter offering his former close collaborator (1931-1940 in Copenhagen) the professorship at Nordita and in his reply Rosenfeld wrote, "I see your offer as a proof of confidence and friendship which deeply touch me and it is with great pleasure that I accept": both letters were in Danish.

In the spring of 1958 the scientific staff consisted of Christian Møller, Gunnar Källén, Ben Mottelson, Léon Rosenfeld and Stefan Rozental. Rozental later became the scientific adviser and formal head of the administration. As for the administration of the CERN study group, one member went to CERN, and the others, the secretary Edith Abrahamsen and the accountant Ebba Larsen, continued as the Nordita administration.

Ten research fellows were hired in 1957.

Denmark : J. Bang and J. Bro-Jørgensen.

Finland: Y. Ahmavaara, P. Kustaanheimo and K. V. Laurikainen.

Norway: F. Bakke and J. M. Hansteen.

Sweden: T. Ericson, P. O. Olsson and H. Wilhelmsson,

There was no fellow from Iceland. The first Icelandic fellow, Magnus Magnusson,



The third meeting of the Nordita Board, 17 November 1958. Front row, from left to right: J. P. Holtsmark, I. Waller, G.W. Funke, S. Rosseland, H. Wergeland, N. Bohr. Back row: O. Klein, A. Bohr, J. Lindhard, E. Hylleraas, J. Bøggild, Leo Nielsen, C. Møller, S. Rozental, P. Jauho.

arrived in September 1958. Three of these fellows (J. Bang, F. Bakke and P. O. Olsson) had fellowships at the CERN theoretical study group immediately before Nordita started operations. Most of these fellows returned to a position in their home countries after the fellowship in Copenhagen: J. Bang, the Niels Bohr Institute; J. Bro-Jørgensen, the Danish National Archive; Y. Ahmavaara, Tampere University; P. Kustaanheimo, Helsinki (returned to Denmark 1975 to take up a professorship at DTU); K. V. Laurikainen, Helsinki University; F. Bakke, NTNU, Trondheim; J. M. Hansteen, University of Bergen; T. Ericson, CERN, Geneva; P. O. Olsson, Stockholm University; H. Wilhelmsson, Chalmers University of Technology, Gothenburg.

Statutes

The first draft of statutes for Nordita was ready in 1958 and sent for approval to the Nordic governments. Before this draft was discussed in the Nordic Council, a meeting was held in November 1958 where the Nordic Council recommended the establishment of a committee including members from the council and the Nordic governments to establish guidelines for the administration of the joint Nordic Institutes. This initiative delayed the process for nearly ten years!

The employees at Nordita, staff and fellows, had so far been treated as employees of an international organization, as the members of the CERN study group had been, and tax free. Their salaries or stipends had been reduced in order to match the Danish level after tax. Nordita's draft statute included tax-free status for employees, as this was in accordance with the conditions for the CERN study group and Danish law and had been approved by the Board. This turned out to be in conflict with the decision by the Nordic Council committee, as it was stated and approved by the members of this committee at a preparatory meeting in June 1958 that tax-and customs-free status, diplomatic immunity and the like should not be granted to the staff of the joint Nordic institutes as one did not want to favour these people compared with the citizens in the Nordic countries.

The Nordic Council committee presented its preliminary report in 1960.² This did not include any of the points Nordita had asked to be taken into consideration. The legal committee of the Nordic Council found that the report could not be used as a model for the statutes and a new committee was formed. This committee published their report in 1964 and this time some observations about the special conditions for the bigger and very different institutions were included in the report.³ It was recommended that the rules for the boards of these institutions should be settled with the individual institutions.

On the basis of these reports new draft statutes was made for Nordita and, after approval in the Board and intense negotiations with the civil servants in the Nordic member states, they was approved by Denmark, Finland, Iceland and Norway. Sweden, however, could not accept the fact that the annual budget was not approved by the governments in advance and it turned out to be impossible to change this opinion in spite of several letters and personal contact with important players, including Torsten Gustafson. Among other contacts, he wrote to the Swedish Minister of Education at the time, Olof Palme, about the problem, but without success. Finally, at a meeting

²Nordisk udredningsserie 1960:2

³Nordisk udredningsserie 1964:8

21 October 1970, the Nordic Council civil servant committee decided to accept the Swedish budget procedure and the convention was approved. At last Nordita had statutes.

The statutes were a very important document, formalizing the financial support and the powers of the Board. Among other things this enabled the Board to draw up the staff regulations, summarizing the salary and pension conditions for the different groups of employees. The first set of rules was approved in June 1972. In 1982 the Nordic Council modified them, and thereafter several adjustments followed.

As for pension arrangements for professors, this question had been very important since the first professor was hired. So far all professors were of foreign heritage and some had pension schemes in connection with their former employment. At that time nearly all professors in the Danish system were civil servants. An insurance for the scientific staff was arranged with the state-owned insurance company Statsanstalten for Livsforsikring in 1963, but this arrangement was only temporary as it did not match the pension conditions for professors in the Danish system at that time.

This situation was perceived by the staff as very insecure. Professor Léon Rosenfeld, who had accepted his professorship in 1958 at the age of 54, found the situation alarming. He wrote to the Board in 1963 complaining that the promised improvements in his pension arrangements had not been made despite the passage of five years. He wrote again in 1966, still awaiting a solution of his special case (combining the pension scheme from the University of Manchester with that at Nordita), and ended the letter “One can hope that the acquisition of the GIER-calculator can speed up this matter”. The last letter about this item was sent in April 1968, 10 years after his acceptance of the professorship. There he appeals to the Board to end this Kafka-like situation and provide an official statement with a specification of his pension agreement.

It was due to the work in the committee formed by the Nordic Council that the proposed pension agreement was delayed. It was realized that the pension agreement could not wait for years as the professors already hired had been promised an agreement. Therefore the Board and director had to contact their respective governments several times and urge them to approve a formal pension scheme, as the Governments had approved of the hiring of the professors. At last in 1966 all the Nordic governments had approved the pension regulations and in January 1967 the first version of the pension regulation Nordita/100 came into force.

The statutes only survived in the form approved by the national governments for two years. In 1972 the newly formed Secretariat for Nordic Cultural Cooperation, an institution formed by the Nordic Council of Min-

isters, took over the responsibility for Nordic institutes and programmes, including their financing.

The story goes that the Secretary General at that time, Hans Näslund (Sweden), went through the national Nordic phone books searching for all companies or institutions beginning with ‘Nordic’ and thus found the various Nordic institutes to be included in his flock. This was the start of a never-ending number of changes of regulations and statutes.

The Board

Nordita was governed by a Board consisting of up to three members from each participating country, all active researchers mainly within theoretical nuclear physics and selected for a period of four years with the possibility of prolongation. The director was also a member of the Board. From its members, the Board elected a chairman and vice-chairman for a period of one year with the possibility of prolongation for up to three consecutive years. The legal secretary of the Board and the head of administration were present at the meetings. The countries had the right to invite national advisers to participate, and for many years Dr. G. Funke, secretary general of the Swedish Atomforskningsrådet, did so.

During the period 1963-1978 the professors at Nordita participated in the part of the meetings dealing with scientific questions. From 1978 in connection with the new statutes, observers from the professors as well as fellows and administration were present at the meetings. The Board decided who should be Director of Nordita; often a member of Nordita’s scientific staff was elected for this task. Until 1977 the decision about Nordic members of the Board was made by the ministries of education in the member countries, but from 1978 the Nordic Council of Ministers made the appointments in accordance with input from the research councils in the member countries.

The Board met at least once per year and decided the guidelines for Nordita’s scientific and administrative business, including the budget, hiring of scientific personnel, and objectives for the scientific activities. It played a key role in determining the scientific profile of the institute, and was one of the drivers of the expansion of Nordita’s activity into broader areas of physics.

In 1970, Professor C. Møller, Nordita’s director, presented a report about the past development of the physics areas at Nordita and some remarks about the future development, based on contributions from the Nordita scientific staff and information from the annual reports about Nordita’s activities. He made the following statement in connection with a proposal to expand the

research areas of Nordita (mainly nuclear physics and high energy physics) into astrophysics, the general theory of relativity (already represented by himself), and solid state physics. “When Nordita was established it was a condition that ‘the activity of Nordita should follow the evolution of theoretical physics. In this connection it was of great importance that the Nordita Board members, in accordance with the rules of Nordita, were Nordic physicists representing theoretical atomic physics with a general idea of the actual research within this area’.” Møller argued for the need to expand the Nordita scientific staff in order to cover the new areas of research. In addition, it was proposed to increase the number of fellows from 15 to 17. The expansion of the scientific staff had to be approved by the Nordic Council as this would increase the budget. An immediate expansion could not be done without increasing the contribution from the Nordic Council and the first employments in a new physics area were made in 1975 in connection with the retirement of Professor Léon Rosenfeld and the part-time employment arrangement with Professor G. E. Brown.

The directors and staff continued over the years to present plans for future research areas and ways of introducing new blood on the Nordita staff. Among these initiatives were the establishment of assistant professor positions up to six years, senior Nordic fellows up to six years, adjunct professors, meetings, conferences, master classes, and Nordic projects. Many of these initiatives could be taken without increasing the budget.

Over the years, the Board appointed a number of *ad hoc* committees within various areas like budget working groups, statute groups and working groups dealing with questions of a scientific nature such as the employment of scientists and the acquisition of scientific equipment, including computers. These committees consisted of some members of the Board and staff, scientists from the Nordic countries with knowledge of the specific field of research and maybe specialists, depending on the task of the committee. To improve contact between the Nordic community and Nordita, subfield committees were set up, and these played an important role, especially in areas such as condensed matter physics and astrophysics, into which Nordita’s activity was expanding. In 1981 there were subfield committees for astrophysics, high-energy physics, nuclear physics, and solid-state physics, and a committee to handle applications for foreign visitors at Nordic institutions. The Board decided on the membership of these committees and the rules for them. The committees advised the Board and worked for extended Nordic cooperation within their fields. The agenda and minutes from the meetings of the committees, including the recommendations, were sent to the Nordita faculty (Professorkollegium). These committees became an important part of Nordita’s Nordic contact net. They received copies of the applications

for fellowships, visitors and meetings for evaluation and acted as advisers when subjects within their field were dealt with. Often the chairmen of the committees were invited to the Board meetings to inform about recommendations when a particular point was on the agenda.

A Nordita Faculty existed since the establishment of Nordita in 1957. The members of this faculty, later called the Professorkollegium, were the professors employed at Nordita and the scientific visitors who participated temporarily in the scientific work and the education of the fellows. After establishment of a junior staff, these members were included in the collegium. In the beginning the faculty met four times a year, later once a month or more frequently. The recommendations from these meetings were sent to the Board.

In 1972, probably in connection with the new rules of the Nordisk Kultursekretariat for Nordic Institutes, the Board decided to form an Executive Committee (Forretningsudvalget) to deal with some of the ongoing Nordita matters and prepare these for the Board. One of the working committees, the Budget group, established in 1966, became part of the Executive Committee. The Executive Committee consisted of one Board member from each country, the director, and the head of administration. After the first meeting, Professor Lamek Hulthén asked the Executive Committee to include the legal adviser in order to ensure the legitimacy of decisions. From 1978 a representative of the scientific staff also participated in the meetings so that it actually functioned as a *de facto* mini board.

The Board could empower the Executive Committee to make decisions on matters transferred to it. The Executive Committee met two or three times a year and minutes from these meetings were sent to all Board members. The number of meetings increased over the years, and during the last five years there were five or six per year. The total number of meetings in 1972-1989 was 71, four of which were held outside Copenhagen. The Executive Committee was abolished in December 1989 in connection with a new set of regulations.

The majority of the first Board members were the physicists involved in the preparations for the Nordita project, including Niels Bohr, C. Møller, P. Jauho, T. Sigurgeirsson, E. Hylleraas, S. Rosseland, J. Holtsmark, H. Wergeland, T. Gustafson, O. Klein and I. Waller. Malte Jacobsson was involved in the early years and participated in the pre-board meetings held in January 1956 and May 1957. It is interesting to note that Rosseland and Waller, the only two physicists who were sceptical about the creation of Nordita at the meeting in Copenhagen, both became part of the first Board.

The first year the Board met three times as there were many things to be discussed and settled in the running of the institute. Thereafter the

Board met once a year up to 1967. The Board was often contacted via correspondence between meetings. Also individual members of the Board frequently visited Nordita for scientific reasons. Niels Bohr was chairman of the Board from the start until his death in November 1962. Naturally, his death was a big loss for the Niels Bohr Institute as well as Nordita; now the institute was on its own.

One may see these first 10 years as a building-up period. As already stated, the Danish state provided Nordita with accommodation and in 1964 Nordita moved into the building that formerly housed the Mathematical Institute. This made it possible to accommodate most of the staff and fellows in one building and the name - Nordisk Institut for Teoretisk Atomfysik - was displayed on the building in bronze letters.



Nordita Board meeting 4 October 1977 in Aud. C. Clockwise from the lower, right-hand corner: H. Højgaard Jensen, C.-G. Fogel, P. Jauho, Pekka Tarranne, Alpo Kallio, Christofer Cronström, Stig Lundqvist, Magnus Magnusson, Johannes Hansteen, Marius Kolsrud, Haakon Olsen, Lamek Hulthén, Aage Bohr, Nils Robert Nilsson and Leo Nielsen.

Over the next 10 years the board meetings became more frequent, usually two per year. Starting in 1975, one of the annual meetings often took place outside Copenhagen, hosted at one of the other Nordic university centres.

When this happened, some members of Nordita's scientific staff accompanied the Board and gave talks and information about ongoing research at Nordita to the physicists at the host institute, and the hosts in turn presented their ongoing research to the Board and the staff members of Nordita. As for the Board members, most of the originally nominated members continued on the Board until they retired from their positions in their home country.

The Board meetings were always important events at Nordita. The preparation of the meetings included many copies of applications for fellowships, visiting scientists, workshops and conferences or other events, the director's report for the period since the last meeting, budgets, accounts, etc., so substantial amounts of paper were sent by mail to the Board members. In connection with the meetings a dinner was often arranged the night before where a more informal discussion of some of the important points on the agenda could take place. Most meetings took place in Copenhagen.



The Nordita Board, 14 March, 2003. From left to right: (sitting) G. Einevoll, P. Minnhagen, A. Andersen, and M. Manninen, (standing) H. Scheibel (legal advisor), M. Larsson, K. Langanke, J. Hertz, L. Thorlacius, C. Jarlskog, P. H. Damgaard, C. Lütken, and G. Björnsson.

Smoking was quite common in those days and there was always a tray with a selection of cigars, cheroots, and many kinds of cigarettes. Unfortunately the administration was not trained in the art of keeping cigars fresh, which often resulted in a small fire when an old dry cigar was lit. Coffee and Danish pastry were served in the morning and soon thereafter many Board members would enjoy their first smoke. This was normal at the time and nobody complained.

For many years a lunch was arranged on the day of the meeting. Participants would include the Board, some of the staff, the fellows and occasional visitors. The impressive luksussmørrebrød (luxury open sandwiches) was delivered from Frederiksberg Smørrebrød, always starting with shrimps or smoked salmon followed by open sandwiches so loaded with meat that one could not see the bread and hardly find it when eating. The smørrebrød would include bœf tatar (beef tartare), liver pâté with salt beef, roast beef, roast pork, hakkebœf (minced beef) with fried onions, mørbradbœf (pork loin) and of course cheese. Some of the fellows competed in how many sandwiches they could eat. For most people, one or at the most two sandwiches plus the shrimps and the cheese would be more than sufficient, but some of the fellows easily consumed three or four. The lunches with the Board continued over the years with smørrebrød from Frederiksberg Smørrebrød, but the get-together with staff, fellows and visitors was changed to a buffet dinner in the NBI lunchroom in the evening before or after the board meeting. The spouses of the staff and fellows were included in these dinners, which were very popular.

Administration

As stated, the Nordita Board appointed the director of Nordita. The director should see to it that the decisions of the Board were implemented. Often the director was chosen from the scientific staff and since the directorship was seen as a part-time job, only a moderate addition to the salary was paid. Some staff members were employed on a part-time basis. If the director was not a staff member he was hired part time for the period of his directorship. The first director was Christian Møller (1957-1971), followed by Bengt Strömgren (1971-1974), who at that time was employed part-time by Nordita, Aage Bohr (1975-1980), employed at the Niels Bohr Institute, Ben Mottelson (1980-1983), James Hamilton (1984-1985), Allan Mackintosh (H. C. Ørsted Institute, the physics part of which was then not part of NBI) (1986-1988), and Chris Pethick (1989-1994). In 1994 it had become financially possible to implement one of the recommendations of the

evaluation report from 1988 and to appoint a full time director from the Nordic countries. The following directors were Paul Hoyer (1994-2002), Petter Minnhagen (1 August 2002–31 August 2005), followed by Paul Hoyer again until 31 July 2006. Thereafter until the end of 2006, Professor Ulf Wahlgren, Stockholm, was director.

As assistant to the director a part-time administrator was hired. The first was Dr. Stefan Rozental, who was of Jewish descent and who in 1938 had fled from Poland to Copenhagen to escape Nazi persecution. In connection with his studies Rozental often visited the University in Leipzig, where Professor Werner Heisenberg worked. Because the situation in Poland became very difficult for Jews, he talked to Heisenberg about his problems. Heisenberg advised him to go to Copenhagen and wrote a letter to Niels Bohr, which was taken to Bohr by a Finnish physicist visiting Leipzig who was going home for Christmas via Copenhagen. Rozental was impatiently waiting for an answer, since his visas were running out. At last he went to Leipzig. Heisenberg told him not to worry, “Bohr never answers letters. You can go without hesitation”.⁴

In 1943, when Jews in Denmark were persecuted, Rozental had to leave Denmark for Sweden where he and his wife stayed until the end of the war. After that he continued his scientific work at the institute and assisted Niels Bohr. When the CERN theory group was established in 1952 he was part of the scientific staff. When Nordita was established he became assistant to the director and head of the administration, while retaining his position as head of the NBI library. With his broad knowledge of science and scientists at that time he was an important part of the administration, especially during the first ten years. Stefan Rozental retired in 1972.

He was followed by Nils Robert Nilsson, from Uppsala, who was assistant to the director (initially Bengt Strömgren) and head of administration, as well as being editor of the Swedish scientific journal *Physica Scripta*. Nils Robert Nilsson divided his working week between Stockholm and Copenhagen, spending approximately three days a week in Copenhagen. His education in physics and his editorial job gave him a broad knowledge of the Nordic physics and physicists and he took the initiative to make Nordita more visible in the Nordic area. He modernized the Nordita preprint series, initiated the Board holding meetings in the various Nordic countries once a year and saw to it that Nordita’s staff and guests visited other Nordic institutes. He was also extremely helpful in securing the assistance and equipment that physicists needed. For example, when Predrag Cvitanović

⁴Stefan Rozental’s *erindringer*, p 178, printed privately by Hanna Kobylinski Rozental, 1997, ISBN 87-986-414-0-9.



Nils Robert Nilsson with Alpo Kallio, Aage Winther and Magnus Magnusson at a reception at the Glyptotek in connection with the Nordita–Landau meeting in 1988.

was working on an article and complained about the lack of peace and quiet, Nils Robert immediately offered him the use of his vacation house at Frebberholm, a beautiful island in Sweden. Predrag accepted and in the article thanked Nils Robert for the hospitality at ‘Frebberholm Institutet för grundläggande forskning’, Östhammar, Sweden.⁵ Nils Robert Nilsson retired in 1993.

The present writer, Helle Kiilerich, was head of the administration during the period 1993-2006. I had been part of the administrative staff since 1964 when I was first employed as secretary and assistant to Edith Abrahamsen, the head of the secretariat. Edith saw to it that over the years I continued my education and, with her guidance in the administrative problems, I became an experienced administrator. After her death in 1972 I took over as the head of the secretariat. In the following years our legal advisor, Leo Nielsen, was a solid supporter, always willing to listen and help out when things were difficult.

⁵Spinors in Negative Dimensions, *Physica Scripta* **26**, 5 (1982).

Secretariat

The first secretary at Nordita was Edith Abrahamsen. Edith Abrahamsen was a qualified interpreter in French and had after her examination during the period 1924-52 several positions as correspondence clerk, secretary to the management and secretary in a variety of companies. During the period 1943-45 she was, like so many other Danes of Jewish heritage, in Sweden, where she worked at an office for refugees in Stockholm. In connection with the termination of World War II in 1945, she was the head of the field kitchen of the Danish Brigade in Sweden. After that she held several positions as secretary, finally at the CERN Theory Division from 15 August 1952 - 30 September 1957. From October 1 1957 Edith Abrahamsen was employed at Nordita as head of the secretariat and secretary to Stefan Rozental and the director.

Edith Abrahamsen made an effort to ensure that future members of the administration possessed an attitude consistent with her ideals. A dedicated secretarial staff, contributing to a good working environment, obliging and service-minded, particularly to staff and visitors from abroad, able to understand and act in accordance with the prevailing guidelines and agreements and at the same time ready to solve problems that arise. This included, when in doubt, consulting the lawyer Leo Nielsen, who was the secretary of the Board and its legal advisor, for a second opinion. As an example I cite the case of Professor Oscar Klein, who was a frequent visitor in Copenhagen. With increasing age he had a problem with vision and needed a guide, which led to the establishment of 'lex Klein', the possibility that the institute could pay expenses for the guide, often the wife, in connection with a visit. Another example was that the institute paid for a first-class single sleeping compartment train ticket for Werner Heisenberg, because he did not wish to fly. Edith Abrahamsen was the keystone in Nordita's administration up to her death in 1972.

When I was interviewed for the job as secretary, Edith took great care to explain that the job as secretary was above all to give service to the physicists and deal with all kinds of problems. One of the examples she mentioned was that one might be asked to fetch clothes from the cleaners or to do other errands, also translate letters in Danish, and thus let the physicists devote their time to research. In this connection one should remember that most of our staff were from abroad and nearly all correspondence with the Danish authorities and public services was in Danish. If I could not see myself in that role I should not take the job if offered. I found that the job sounded extremely interesting. There were not that many 'international' jobs, and as in my summer vacations from school I had had jobs as strawberry picker,

cafeteria waitress and assistant in a silver shop, I was not scared by the demands of service. As this was the first and only job advertisement I responded to after completing my first professional training I was very eager to get the job and called Edith several times to hear if a decision had been made. I learned later that it had been considered maybe too risky to hire one so young, but Leo Nielsen, when asked, told them to go ahead.

The importance of service and willingness to be an all-around secretary continued to be important in connection with future employment of the administrative staff. The administrative personnel were very loyal. Many stayed on until retirement, but a number of secretaries were ‘exported’ as they married physicists temporarily working at Nordita. During the period 1957-2006 a total of 37 people were associated with Nordita’s administration for shorter or longer periods. This includes five bookkeepers. I shall here only list the secretaries working in the service group for a longer period. All worked for one or more of the Nordita professors and their groups, including assistant professors, visitors and fellows, and in addition assisted with the general administrative functions.

Edith Abrahamsen, head of secretariat 1957-1972.

Ebba Larsen, bookkeeper 1957-1964.

Henny Abrahamsen 1963-1971, secretary to Léon Rosenfeld.

Grete Møller Nielsen 1961-1984, secretary to Ben Mottelson, in charge of publications and announcements for lectures etc.

Inger Wadil, bookkeeper 1964-84, thereafter publications 1984-1989.

Helle Kiilerich, 1964-2006, secretary to Edith Abrahamsen and Nils R. Nils-son, head of the secretariat 1972, head of administration from 1993.

Inge Søndergaard, 1973-88, secretary to Bengt Strömgren and James Hamilton.

Elsebeth Vinther (Manninen), 1973-1981, secretary to Ben R. Mottelson and G. E. Brown.

Vivi Bech (Grinstein), 1974-1979, secretary to Alan Luther, John Hertz and John W. Wilkins.

Hanne Bergen, 1976-2006, secretary to Chris Pethick, Dmitri Diakonov, and P. Hoyer.

Ellen Kjeldtoft Pedersen, 1980-2006, secretary to Alan Luther, John Hertz, and A. R. Mackintosh.

Anna-Maria Rey, 1982-2006, secretary to Ben R. Mottelson and Paolo Di Vecchia.

Birthe Thorup, 1984-2001, bookkeeper.

Anne Lumholdt, 1989-2005, secretary to Bernard Pagel and Axel Brandenburg.

Jette Nielsen, 1989-2003, publications, housing.

Katarina Sundqvist, 2001-2004, bookkeeper.

Ragna Heide, 2004-2006, bookkeeper.



The Nordita coffee room, 25 August 1995 . From left, Helle Kiilerich, Anders Krogh, Anna-Maria Rey, Anne Lumholdt, Jette Nielsen and Ellen Pedersen.

As for the administrative responsibilities, including the finances, Nordita was not part of the university or the Niels Bohr Institute. All payments in and out, including salaries and the taxes in this connection, were administered by Nordita's administration, which included one of the secretaries as part time cashier and a bookkeeper. All office equipment and supplies, as well as printing costs were paid by Nordita. The only free item up to 1962 was the use of the few central computers. The accounts were checked and approved every year by the Danish National Audit.

The secretariat also dealt with bureaucracy in connection with visa applications and extensions, tax exemptions for our Nordic fellows, and special arrangements about taxes and visitors, especially long-term ones from the USA and the USSR. As for housing, there was a collaboration with the Niels Bohr Institute to find lodgings for fellows and visitors, but helping with housing problems was also part of the secretarial responsibilities.

In connection with the increasing size of the institute, more visitors, workshops and meetings, the administration was enlarged from three in 1958

(a bookkeeper, an administrator and a translator/publications secretary), to six in 1965 (an administrator, a bookkeeper, publication secretary and three secretaries).

The tasks of the administrative staff were many and in an age before computers and e-mail, telephone calls and telegrams abroad were expensive, so these means of communication were only used when absolutely necessary. Nordita had its own cable address, 'Nordita Copenhagen'.

Each professor or group had its own secretary who took care of the scientific correspondence and letters to visitors, ranging from letters up to five pages about a physics problem to a letter about a hotel reservation. When typing manuscripts, in general the secretary typed the words, but the formulas were inserted afterwards by hand by the scientist. In case there were too many manuscripts to handle, some were sent to able typists working at home using a typewriter from the institute. Also the arrangement of meetings and workshops in cooperation with the scientists formed part of the administrative duties and included booking of accommodation and reimbursement of participants.

Other tasks were the ordering of tickets in connection with journeys for the staff and fellows, handling of visits from abroad, arranging hotels and maybe tickets, calculation of travel expenses for staff and visitors – I clearly remember Matts Roos (Helsinki) teaching me how to do the per diem correctly by using the fingers when counting, as per diem was per 24 hours, which in the beginning could confuse me. Also included was the preparation of the annual report, information about colloquia to be distributed, later a monthly newsletter, and all other correspondence in connection with the running of the institute.

When I started working at Nordita in 1964, Professor Léon Rosenfeld's secretary, Henny Abrahamsen, would take down in shorthand his long letters, several pages in French or English, and afterwards type the letters on a non-electric typewriter, with very few, if any, mistakes. Most professors would give a handwritten letter to be typed or instructions about letters of invitation to be typed. A few scientists like professor Gerry Brown and Sir Rudolf Peierls, who was a visiting scientist at Nordita for some months, were very good typists themselves and often typed their articles or letters. One of the fellows, Dan-Olof Riska (Helsinki), was really impressive: he even used hearing protection when typing. I learned later that his skills as a typist had to do with some student job he had had in Finland. Apart from letters and articles, many of Nordita's professors and long-term visitors gave lectures at the institute and produced lecture notes, which Nordita published.

The articles and lecture notes, preprints and reprints produced at Nordita were distributed worldwide. In those days one used stamps and the post

office. The general rule was to buy nice stamps in order to please stamp collectors. The stamps from incoming mail were collected for some charity organisation. Later we had an electronic postage system, but we kept a collection of interesting stamps for special occasions like inviting participants to a special conference. We would use the stamps that had Niels Bohr on them even if it was a bit complicated to use several stamps in order to get the right postage.

Nordita had a general mailing list, containing the Board, some of the committees and the university libraries in the Nordic area. Later Nils Robert Nilsson initiated a complete list of physicists in the Nordic area, to be used in connection with contacts to specific physicists. This list was later transformed into an e-mail list. Also, the authors had their own lists of people to whom they wished to send preprints. Some lists contained 50 or more names and the distribution of these preprints was done by the publication secretary. The publication secretary was also in charge of the handling of manuscripts, ordering preprints and reprints, arranging printing, drawings and mailing articles on demand. Up to 1975, Nordita reprints were sent to a printing firm that put special covers on them and they were subsequently distributed. Nordita had ordered big red binders with the numbers of the reprints in gold on the spine. These binders were distributed to the Board, the committees and university libraries. This system became too expensive and maybe too slow and the distribution of reprints was later done without the special covers, since most of the articles had been distributed as preprints. Printing techniques had become so good and inexpensive and the printing of preprints was done by smaller printing companies with a special cover. The annual reports, listing all staff, fellows, visitors, and meetings, in Danish and English, were reproduced and bound out of house, but distributed by the publication secretary.

Computing

The use of electronic computation in connection with scientific research developed rapidly. In 1962 John H. Gunn (who had done his PhD in Birmingham under the supervision of Gerry Brown) was hired with the specific task of planning and organising work on electronic computers in cooperation with the Niels Bohr Institute. (John Gunn left Nordita 31.12.1971 to become director of RECKU). During this period the equipment was mainly a GIER machine at the Astronomical Institute, but it was also possible due to the generosity of the Rutherford Laboratory in the UK to use their big computer. This was the first step into computerized calculations and research.

Since then computing has been an item on the agenda of Board meetings and a separate entry in Nordita's budget and accounts.

Around 1966 a GIER machine was installed at the Niels Bohr Institute for the use of NBI and Nordita, and a computer centre, NEUCC (Northern European University Computing Centre), was established at DTH (later DTU) under an agreement with IBM. The Danish state paid for the buildings and personnel and IBM supplied the computing equipment. This centre was intended for the use of Northern European countries, including the Nordic ones. In 1972 NEUCC became a regional centre and remained so until 1985. John Gunn has given an impression of computing during the 1960s.

Theoretical physicists (and many others) had a long tradition of numerical computation by hand - and in the decades up until the sixties - with mechanical aids such as slide rules, and hand or electric calculators. But numerical computation with these devices was tedious and slow so access to electronic computers in mid sixties opened up new possibilities to speed up the process.

Whereas the use of the mechanical aids was easy to learn, the advent of computers required learning new disciplines. First of all, a computational process had to be described with the help of a computer language with strict rules of syntax. To use the GIER computer, the language was ALGOL for the IBM computer the language was FORTRAN. Learning to use such languages required a not insignificant effort. In the beginning, no standard software packages were available for the calculation of the many mathematical functions or numerical solution of differential equations so development of useful programs was slow - but once developed could be used and reused. Later on standard software packages were developed - in particular by the numerical analysis group at Oxford University.

Secondly, the computer program had to be transferred from paper to a medium that could be 'read' by the computer system input device - terminals with screen and keyboard first appeared in the seventies! The GIER computer input was on paper tape with punched holes - each row with up to 8 holes representing letters, numbers and special characters. The paper tape containing the entire program and data was prepared on special electric typewriters ('Flexowriter') that punched the holes and produced a printed copy. One single typing error resulted in the program being useless and the paper tape had to be copied up to the point where the mistake was made, the correction inserted and

the remaining correct section of tape copied to the new tape. NBI/Nordita hired personnel for this task. For the IBM computers punched cards were used. Each card contained one line of program and was prepared on special machines. No overall paper printout was available from the punch machines - but the content of each card could be read on the card. Errors were easier to correct with punched cards - only the faulty card(s) needed to be replaced.

Once the program and data input was prepared they could be queued up to be read into the respective computer. Early computers were only capable of processing one program at a time and at such a slow pace that users of modern super computers, personal computers, tablets and telephones have difficulty in believing that useful results came out of these efforts!

An increasing number of the physicists used computing as part of their research, especially astrophysicists, and very soon the computer capacity was far from adequate. Fellows worked throughout the night in the computer room and even Christmas Eve was fully booked.

In 1969 two Danish university computing centres were established, in Copenhagen (RECKU) and Aarhus (RECAU). In 1985 these two centres and NEUCC were amalgamated as UNI-C, The Danish Computing Center for Research and Education.

Nordita's share of the running costs of the computing facilities was based on the actual use and paid to the Niels Bohr Institute. In 1970 the estimated use was 50 GIER hours, the market price of which would have been close to half a million Danish kroner, but Nordita paid only 141,000. Later an agreement was made for Nordita to hire an assistant for the computer manager at the NBI, and the shortage of skilled personnel resulted in frequent changes of the assistants.

The evolution of computer systems continued and in 1987 Nordita bought a SUN-4260-260 Graphic Station from the USA, following a strong wish especially from researchers in chaos and astrophysics. This step outside the NBI computer arrangement was met with some scepticism from the management of the NBI. In connection with the establishment of the SUN system one of the fellows spent part of his fellowship as computer manager for this system. In 2001-02 Nordita changed to a Linux server system and the need for a more stable assistance and development of Nordita's computer system led to the hiring of a computer manager, Petter Urkedal from August 2002. E-mail connections became available from the mid 1980s and internet from around 1989.

Typewriters too went through an evolution. From the 1960s IBM and Adler had developed electric typewriters and in the beginning of the 1980s Facit had developed a typewriter with a 40 page memory and the possibility of adding a disc station. This was a big step forward for the secretarial work, as standard letters, reports, recommendation letters and manuscripts could be saved and easily corrected. Soon afterwards the first word processing programs became available - Word Perfect, Word, Latex - and a new era of secretarial work began.

Nordita's Scientific Staff

The backbone of the scientific research at Nordita was the staff of tenured professors recruited internationally. Following the initial appointments, Gerry Brown was added in 1960 and James Hamilton in 1964. During the early years, the research of the professors and the director included broad areas of the modern physics at that time, especially nuclear physics, particle physics, and the theory of relativity. Within these areas there was a broad scientific interest in the Nordic countries and a strong scientific environment at the Niels Bohr Institute. The return of Bengt Strömgren to Denmark in 1967 and his becoming associated with Nordita marked the beginning of research in astrophysics at the institute. Later in 1970 following a strong wish from Finnish and Swedish Board members, solid state physics was included. The areas of topical interest are constantly shifting, and the methods of theoretical physics are finding new applications in other sciences such as biology and earth sciences, not to mention technology and even finance. The number of tenured professors was increased to five in 1976 and six in 1980. In addition the possibility from 1972 of hiring a number of assistant professors and senior fellows for up to five years, made it possible to enter new areas of research rather quickly. A list of staff members is given in Appendix C. To better reflect the fact that research in numerous areas of physics was carried out at the institute, the official name of the institute was changed to 'Nordisk Institut for Teoretisk Fysik' in 1989 and the 'atom' was removed from the facade. However, the abbreviation 'Nordita' was retained.

Another way of bringing in new research and inspiration was via long term visiting scientists such as professor John W. Wilkins, then at Cornell, who was a visiting professor for more than three years during the period 1975-1980 at Chalmers in Gothenburg and Nordita in Copenhagen; he was very active in building up solid state physics and trained a number of fellows. Some physicists visited year after year for a month a more or several times per year during the first 10-15 years physicists like Oskar Klein (Stockholm), Har-



James Hamilton, 1976.

ald Wergeland (Trondheim), Hans Bethe (Cornell), Bertel Laurent (Stockholm), and Alfred Schild (U. of Texas). Later physicists like Gordon Baym (U. of Illinois), and J. R. (Bob) Schrieffer, were regular visitors. Admittedly it was often a combination of family relations and physics cooperation. Also Nordic physicists, among them Sven Gösta Nilsson (Lund), Alf Sjölander (Gothenburg), Ketill Ingolfson (Reykjavik), and Esko Pietarinen (Helsinki), spent longer periods at Nordita. It was also possible for Nordic as well as foreign physicists to spend some time at another institute in the Nordic area as a visiting scientist supported by Nordita.

Other ‘positions’ were adjunct professors, associated scientists and Nordic corresponding fellows. Adjunct professorships were offered to scientists mostly from outside the Nordic area who were prominent figures in their research

fields and were willing to assist Nordita for a specific period. In 1997 they were Wilfried Buchmüller (DESY, Hamburg), Igor Novikov (TAC, Copenhagen), Itamar Procaccia (Weizmann Institute, Israel), Bob Schrieffer (Florida State U.), and Wolfram Weise (TU Munich). When Nordita professors like L. Rosenfeld retired, they continued their work and those living in Copenhagen came to the institute as before.

The associated scientists and Nordic corresponding fellows were mostly Nordic physicists with good knowledge of the needs and interests within their research field in the Nordic area. Besides carrying out research, they suggested subjects for meetings and conferences and sometimes arranged these in cooperation with the Nordita staff.

Throughout Nordita's existence, its research programme has been under continuous change and expansion. Nordita was in a particularly strong position to encourage research in emerging fields. A large fraction of its research staff was renewed over a period of five years. This gave the institute good opportunities to enter new areas rather quickly. In the hiring of new staff the Nordita Board was constantly trying to find the proper balance between development of new research areas, and the above-mentioned need for continuity and long range persistent efforts to succeed in a field.

Nordita's scientific activity was greatly enhanced by the use of funds from external sources. These ranged from salaries from their home institutions for sabbatical visitors and postdocs when visiting Nordita. Also some fellowships at Nordita were funded by private foundations, such as the Carlsberg Foundation. After 1992, the EU contributed with fellowships for younger researchers via, initially, an institutional postdoctoral program and, more recently, by Marie Skłodowska-Curie fellowships for individuals.

Nordita Fellows

The purpose of Nordita fellowships was to educate and train young Nordic physicists, and the programme was one of the most important activities at Nordita. These fellowships were granted to younger physicists who had a basic education in physics and had studied special areas within physics for a period of two to seven years. Most fellows worked at Nordita, but a few of them were at other Nordic institutions when appropriate expertise was not available in Copenhagen. Most fellowships were for two years, but in exceptional cases a third year was granted. The fellowships also provided support for participation in scientific meetings and conferences. In addition, one visit per year to the home institute was granted and, in the event of an extension of the contract, the fellow and family were granted a visit to his

or her home country with Nordita covering the travel expenses.

The purpose of the fellowships was further education of the fellows, including guidance in research work within theoretical physics. The fellows were not allowed to undertake other jobs beside the fellowship, which was to be full-time research. The monthly salary was decided by the Board and adjusted once a year. Fellows from Denmark were taxed in Denmark and received the full stipend. Other Nordic fellows were in principle taxable in their home country, where stipends were not taxed, and they received 60% of the full stipend. Fellows also received a contribution to pensions. For fellows subject to taxation in Denmark, this was paid out together with the salary. For other fellows, the pension contribution was deposited in a special account and, on leaving Nordita, the fellow received the pension contributions plus interest. These rather large amounts were very much appreciated by fellows in the process of establishing themselves elsewhere.

During the period 1957-1975, the selection of fellows was made by the Board, based upon proposals from Board members in the individual member countries. From 1960 the Nordita faculty were involved in the discussions, but the final decision lay with the Board. The national distribution depended on the number of applicants, their qualifications and the share the country contributed to Nordita's budget. In general the distribution was: Denmark, Finland and Norway, three to four fellowships each; Iceland, one fellowship every few years; and Sweden, four to five fellowships.

Nordic senior fellowships were introduced from the academic year 1973/74 and were granted to applicants with greater knowledge and experience who were in a position to pursue an independent research programme and take part in the supervision of younger fellows. These fellowships were granted for two years with the possibility of prolongation for a third year. Just as for assistant professors, extension for more than three years could only take place based on a new scientific evaluation. In 1979 the salary and employment conditions for senior fellows and assistant professors were made equal, and for both groups employment beyond six years could not be made without the approval of the NMR.

Until 1976 applications for fellowships were sent to the applicant's home country. After 1976 applications were sent directly to Nordita, and after a scientific evaluation by an appointments committee, a proposal for fellowships was made by the faculty and the executive committee. Here one also looked into the national distribution and the final decision was taken by the Board. After the introduction of new governing rules by the Nordic Council of Ministers in 1989, the executive committee ceased to exist and the Board decided on fellowships upon advice from the faculty based on reports from the subfield committees.

During the period 1957–2006 the total number of Nordita fellows (including senior fellows) was 335. Of these 83 were from Denmark, 80 from Finland, 12 from Iceland, 56 from Norway and 104 from Sweden. Most of the fellows were male, because there were few women working in theoretical physics. In recent years, the number of female fellows increased, and of the total of seventeen female fellows, fourteen came to Nordita after 1985. Of the fourteen there were five Danes, three Finns, one Icelander, one Norwegian and four Swedes. The fact that of the seventeen female fellows seven were from Denmark may be due to the fact that taking up a fellowship usually required moving to Copenhagen.

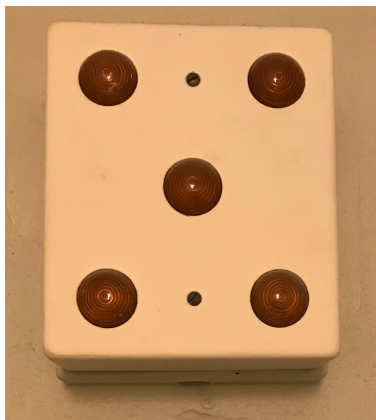
Lectures, Colloquia, and Scientific Meetings (with contributions by Marek Abramowicz and Finn Ravndal)

The fellows and visitors could follow the courses of lectures given at the Niels Bohr Institute, or by members of the Nordita staff. In addition, Nordita arranged a series of seminars, each consisting of two to four lectures given by members of Nordita's scientific staff, senior as well as junior.

Also a number of colloquia by visiting scientists were arranged by Nordita and the Niels Bohr Institute. During the first 25 years, colloquia were arranged several times a week during the academic year at specific times, 2 pm or 4 pm. Later one gave up the colloquia at 4 pm because some of the younger people pointed out that they had domestic responsibilities like fetching children from kindergarten, which usually closed at 5 pm.

At that time smoking was allowed and traditionally the front rows of Auditorium A were occupied by the senior staff. I recall the large ashtrays on the front rows in Auditorium A and the clouds of smoke from the professors' pipes and cigars. Auditorium A could only seat about 50 people. If there were more listeners the institute provided folding chairs, which still exist and are in use more than 50 years after. The benches in the auditorium were plain wood without padding. Sitting there through a conference was a challenge and some participants complained about this, but were told that this was a way of keeping people awake.

The institute had a special arrangement connected to the internal phone system. As people would often be out of office, working in the laboratories or talking to colleagues, the institute had a call system. In all offices, auditoriums, hallways and corridors, on the wall about three meters up there was a little wooden box (15 cm by 20 cm) with 5 red lamps on the front. If the person one called was out of office, it was possible to transfer the call to



There are still a number of the boxes for the call system in the Blegdamsvej complex.

the call system. People calling from outside could ask the receptionist to do so. When a call was transferred through this system there would be a noise and the lamps would light up in a pattern specific for the person one wanted to contact. He or she would go to the nearest phone to answer the call. If he responded too late there was a possibility of dialing 'I am here now'. Apart from calling a particular person, one could send a message to a specific group, using a code understandable only by people who knew the system. One of these messages was 'Not enough listeners in auditorium A', telling people to come quickly to listen to a colloquium about to begin; another signal would ask for one of the technical staff. Of course the system had limits in the number of combinations, but at least the scientists in greatest demand had their own signal. I am sure one of my readers will be able to calculate how many different signals were possible. This system was used at the institute until 1995. According to Flemming Bo Hansen, for many years the head of the building maintenance staff at the institutes, this system was operated by mercury relays and was very reliable. The same system was used by H. C. Ørsted Værket (a large power station in Copenhagen), and the central fire station of Copenhagen.

One of the obligations of Nordita was to organise and support meetings on subjects within theoretical physics. For technical reasons, until 1967 Nordita's effort in this respect was mostly financial support to meetings in the Nordic area, but not arranging meetings themselves. From 1971 the number of meetings, workshops and conferences arranged by Nordita increased. The average number of meetings per year during the period 1972-

1982 amounted to 4,5 arranged by Nordita and 4,3 in the Nordic area receiving support. According to Nordita's annual reports, in the years 1982-2006 Nordita supported an average of 7 meetings, conferences, and workshops per year outside Copenhagen and arranged 6.1 per year in Copenhagen.

The very first international meeting took place in Trondheim in 1967. At its meeting in May 1966, the Board decided to arrange, in cooperation with the local staff in Trondheim, an international conference on statistical mechanics in Trondheim, June 16-20, 1967. The number of participants was about 50. The conference included a fair number of Russian and American physicists, among these the famous Norwegian professor Lars Onsager, who had his exam as civil engineer in 1925 from NTH (the Norwegian Technical Highschool, Trondheim). Later, in 1928, he emigrated to the USA. Over the years he received honorary degrees from several universities and received a number of medals and prizes, among them the Nobel Prize in Chemistry in 1968. It was said to be his first visit to Trondheim after his emigration.

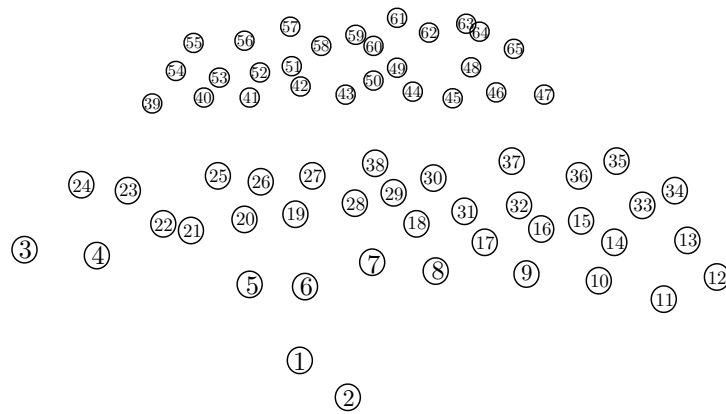
I came along as part of the administrative team in Trondheim. This was my very first journey by air, and as the plane between Oslo and Trondheim did not have a pressurized cabin, I was told that now I was truly airborne. The conference took place at the time when the Six-Day War between Israel and Egypt (June 5-11, 1967) had just taken place, and the organizers were uncertain whether the Russian delegation would have to cancel its participation. Fortunately this did not happen. During the conference this war was the subject of several discussions. The conference was a big event for the city of Trondheim. The local newspaper wrote an article and the photographer came by to take a photo – he was very eager to know who the Russians were. This surprised me, since Soviet scientists often visited the Niels Bohr Institute without any fuss.

The owner of a large factory producing steel wires had arranged the conference dinner at the glamorous Hotel Britannia. When the participants arrived at the hotel there was an orchestra playing in front of the hotel and the participants sneaked behind this to get in. Later it turned out the music was for the benefit of the participants. Professor G. E. Brown and his family were at that time returning by car from a trip to the northern part of Norway. They had stopped in Trondheim and were walking in the city when they heard the music and went to see what was happening – it was a surprise to Gerry and his family when they realized it was actually the Nordita/NTH conference participants arriving for dinner. The participants too were surprised to recognize the tall Gerry in the local crowd of people.

The next international meeting was the Sixth International Conference on Gravitation and Relativity (GR6), 5-10 July 1971. Professor C. Møller, Director of Nordita at the time, and President of the International Com-



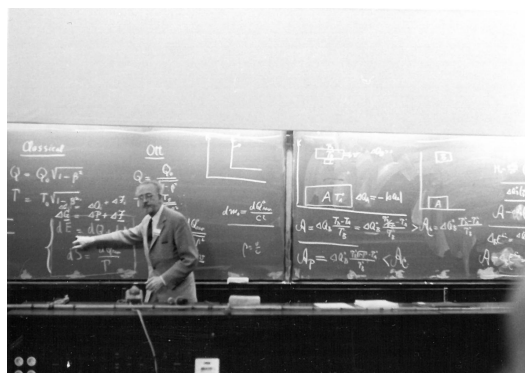
Group picture at the international conference on statistical mechanics in Trondheim, 5-10 July 1967.



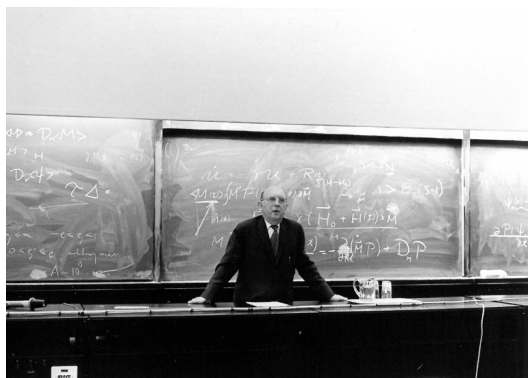
- | | | | | |
|-----------------------|-----------------------|----------------------|-----------------------|---------------------|
| 1 Blomberg son | 13 E. J. Verboven | 26 U. Uhlhorn | 39 ? | 52 P. C. Hemmer |
| 2 Blomberg son | 14 J. L. Lebowitz | 27 I. Waller | 40 F. Bakke | 53, 54, 55 ? |
| 3 T. Toyoda | 15 P. Résibois | 28 C. Blomberg | 41 M. F. Sykes | 56 K. Mørk |
| 4 S. Rozental | 16 H. Højgaard Jensen | 29 Torsten Gustafson | 42 G. W. Ford | 57 P. Bona |
| 5 Mrs Toyoda | 17 Yvonne Rosenfeld | 30 I. M. Khalatnikov | 43 R. Kubo | 58, 59, 60 ? |
| 6 Mrs Blomberg | 18 M. E. Fisher | 31 P. Mazur | 44 V. P. Silin | 61 A. Lenard |
| 7 Mrs Gustafson | 19 Christian Møller | 32 B. Bergersen | 45 L. P. Pitavskii | 62 E. Lieb |
| 8 Mrs Højgaard Jensen | 20 J. E. Mayer | 33 E. Præstgaard | 46 C. D. De Dominicis | 63 H. Kiilerich |
| 9 Hanna Kobylinski | 21 Lars Onsager | 34 A. Thellung | 47 Harald Wergeland | 64 P. W. Kasteleyn |
| (wife of S. Rozental) | 22 Léon Rosenfeld | 35 R. Balescu | 48 E. G. D. Cohen | 65 B. R. A. Nijboer |
| 10 Mrs Thor Bak | 23 Konrad Bleuler | 36 T. A. Bak | 49 S. F. Edwards | |
| 11 Mrs Kirsten Møller | 24 J. Ginibre | 37 G. E. Uhlenbeck | 50 A. Loinger | |
| 12 Mrs Verboven | 25 I. E. Farquhar | 38 Alf Sjölander | 51 T. Nilsen | |



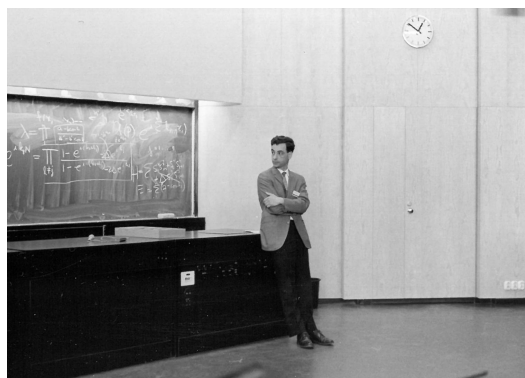
A. Thellung
C. Möller, K. Bleuler, J. Meyer, G. Uhlenbeck



Christian Möller



Léon Rosenfeld



Elliott Lieb

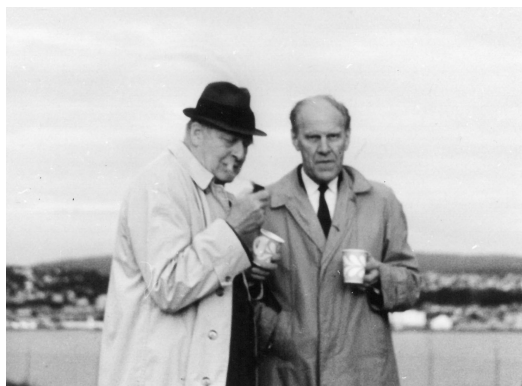


Harald Wergeland and Torsten Gustafson



G. Uhlenbeck and C. Möller

Snapshots from the Trondheim meeting



L. Onsager and S. Westin



A. Coriciovei, J. Ginibre, I. Khalatnikov, S. Rozental



P. Hemmer and E. Cohen



C. De Dominicis, P. Résibois, J. Lebowitz, E. Cohen, H. Kiilerich



G. W. Ford, L. Onsager, J. E. Mayer



P. Mazur and Edith Abrahamsen

More snapshots from the Trondheim meeting

mittee on Gravitation and Relativity, had been asked to arrange this meeting, which he did together with the local organizing committee Professor L. Rosenfeld, Dr. S. Rozental, Professor A. Schild (Austin) and Professor B. Strömgren.

I here quote part of the opening speech by Professor Christian Møller.

Since 1955, the number of participants in the conferences has been constantly growing in proportion to the number of physicists working in the field of relativity. For many years, and already when I was a student in the middle of the twenties, most physicists thought that the Relativity Theory was finished, and that it did not offer any new interesting problems. This is also reflected in the piece of advice which Niels Bohr gave me when I met him for the first time in the autumn of 1926. He asked me which part of physics I was most interested in. Among other subjects I mentioned the theory of general relativity, to which he replied that Einstein's work had been of profound importance for physics and epistemology since it had brought about a radical change in our way of thinking; but now, he said, all problems are solved in this field, and he advised me to concentrate on problems in quantum theory, which was just then nearing its completion. At that time, this was certainly the best piece of advice to give a young man. Compared with the spectacular achievements of quantum theory in physics and epistemology, with its many applications in technology which have changed the conditions of human life so completely, the theory of general relativity seemed rather academic and remote from the realities of life.

This situation lasted for about forty years. The few physicists working in the field of relativity – the relativists as they called themselves – formed a clan, or rather a small sect which was somewhat looked down upon by other, more successful groups of physicists. However, the development of the last ten or fifteen years has brought a complete change in this respect. In the first place, extensive investigations, in particular by the younger physicists and mathematicians, has given us much better understanding of the mathematical structure and of the physical contents of the theory. Secondly, the astonishing development of experimental technique and the collaboration with our astrophysics friends has given us new experimental tests of the theory, and opened up the possibility of new exciting applications of the theory in cosmology. In a way, this development is not

surprising, for in contrast to the Newtonian gravitational field which acts only on ponderable matter, the gravitational field in Einstein's theory has an influence on all physical phenomena. Thus, although this influence is usually extremely small, an ever increasing accuracy of our measuring instruments will probably also in the future reveal more and more general relativity effects.

About 230 physicists participated in the conference and the meeting took place at the H. C. Ørsted Institute as the Niels Bohr Institute had no auditoria large enough for so many participants. The student hall of residence, Egmont Kollegiet, was used as a hotel in the summer and most of the participants stayed there. Again the participants were an international mixture of Americans, Europeans and Russians, including, according to the Russian participants, two KGB agents.

During the meeting one of the American participants insisted on giving a talk about the mistreatment of the dissidents in the Soviet Union. He could not be stopped and was at last allowed to give his talk in one of the smaller auditoria. My impression is that the organizers would prefer to preserve the connection with their Russian colleagues and not risk losing the opportunity to meet on 'neutral' ground due to some American's wish to talk about a well known fact.

One of the Russian participants, Professor L. D. Faddeev, was secretly taken away from the conference to receive a new hearing aid from a Danish factory with very good reputation. Others needed medical advice or medicine and Dr. Rozental, Ms. Abrahamsen and others were very helpful.

The Danish brewery Carlsberg provided the conference dinner and Léon Rosenfeld arranged the performance of a small play about gravity, in which the actors were some of the physicists and members of the local office staff.

In the following years, meetings and workshops became a normal part of Nordita's scientific profile. Most of the participants in the meetings were Nordic physicists working within a specific scientific field or interested in new areas in theoretical physics, which over the years included astrophysics, solid state physics, biophysics, and chaos. For the fellows of Nordita this was a good opportunity to get acquainted with new ideas and developments in theoretical physics.

When arranging the meetings one tried to get together representatives from every Nordic country and some physicists within the field from other



Participants at GR6 at an organ recital in Frederiksborg Castle Chapel.



Participants at GR6, the 6th International Conference on Gravitation and Relativity, 5-10 July 1971 at a reception at Copenhagen City Hall.

Programme for the Morning Sessions (starting at 9.30)	
Monday, July 5th	New developments in general relativity (Chairman: A. Lichnerowicz) R.P. Geroch Possible structures of physical space time B. DeWitt Theory of superspace
Tuesday, July 6th	Effects of gravitational fields and their observation (Chairman: R.H. Dicke) K.S. Thorne I.I. Shapiro
Wednesday, July 7th	Propagation of gravitational fields (Chairman: H. Bondi) D.W. Sciama J. Weber
Thursday, July 8th	Gravitational collapse and related phenomena (Chairman: J.A. Wheeler) I.D. Novikov P.J.E. Peebles
Friday, July 9th	The universe in its early state (Chairman: B. Strömberg) C.W. Misner I.M. Khalatnikov Summary A. Trautman

Programme for Parallel Afternoon Sessions (14.30 - 17.00)				
The Chairmen of the afternoon sessions will post the list of speakers on the bulletin board. Please consult the board.				
Monday July 5	General Relativity and Quantum Mechanics A (Role of gravitation in elementary particle physics) Chairmen: A. Salam, S. Deser	Theoretical Problems A (Relativistic thermodynamics and statistical mechanics) Chairmen: C. Møller, J. Ehlers	Experiments A (Solar oblateness, scalar-tensor theories) Chairmen: R.H. Dicke, P.J.E. Peebles	Relativistic Astrophysics and Cosmology A (cosmological theories) Chairmen: N. Rosen, I.M. Khalatnikov
Tuesday July 6	General Relativity and Quantum Mechanics B (Possible quantum effects of gravitation) Chairmen: P.G. Bergmann, R. Utiyama	Theoretical Problems B (Singularities in cosmology, collapse, other topics) Chairmen: R. Penrose, S.W. Hawking	Experiments B Chairmen: W.D. Allen, B. Bertotti	Relativistic Astrophysics and Cosmology B (quasars, pulsars, etc.) Chairmen: W.A. Fowler, G. Baym, J.M. Bardeen
Wednesday July 7	Excursion	- - -	- - -	- - -
Thursday July 8	General Relativity and Quantum Mechanics C (Quantization of gravitational fields) Chairmen: A.B.A. Komar, C. DeWitt	Theoretical Problems C (Exact solutions) Chairmen: E.T. Newman, R.P. Kerr	Theoretical Problems D (Equations of motion) Chairmen: A. Schild, A. Trautman	Relativistic Astrophysics and Cosmology C (Latest on Hubble constant, age of universe, deceleration parameter) Chairmen: B. Laurent, E.L. Schucking
Friday July 9	Other Topics Chairmen: W. Israel, Y. Choquet-Bruhat, P. Florides	Theoretical Problems E (Topology, differential geometry, etc.) Chairmen: C. Cattaneo, A.Z. Petrov	Overflow from other Sessions	Relativistic Astrophysics and Cosmology D (Black holes) Chairmen: J.A. Wheeler, I. Robinson

Programme of GR6, the 6th International Conference on Gravitation and Relativity, 5-10 July 1971.



Jesper Sommer-Larsen, Francesca Mateucci and Henrik Vedel discussing at the Workshop on Active Galaxies and Chemical Evolution, 23-26 April 1990.

countries. The international staff at Nordita had the advantage of their personal relations to many physicists outside the Nordic area. In addition, many of the 'old boys' in physics had a tradition of visiting the Niels Bohr Institute and Nordita during the summer period and thus became acquainted with the new generation. In this connection I can mention Hans Bethe, Harald Wergeland, Gordon Baym, Oskar Klein, Bob Schrieffer, Torsten Gustafson, David Pines, Alfred Schild, John Wheeler and many others. The larger international conferences were often on new developments in physics and here too there were many Nordic participants. Marek Abramowicz gives a charming account of a conference in Iceland he arranged in 1997 with support from Nordita.⁶

⁶Excerpted from a speech Marek made at the retirement celebration for his secretary, Birgitta Högman in 2013.

The First Astrophysical Conference in Iceland

Marek Abramowicz

A long, long time ago, in some very ancient times, all university professors used to have personal secretaries. When in 1993 I became a professor at CTH (Chalmers University of Technology in Gothenburg), the University immediately organized a competition for the position of my secretary and Birgitta became my secretary. One day, Birgitta and I decided to organize a Very, Very Important International Conference, at the end of the world, in a small village, an hour's drive from Reykjavik – the first ever astrophysical conference in the history of Iceland.

Several of my famous colleagues, including Jean-Pierre La-sota from Paris, Ramesh Narayan of Harvard and Bob Wag-oner of Stanford, formed the scientific organizing committee, which worked out a detailed plan for the conference, and above all suggested an impressive list of invited speakers. We applied to several serious sponsors, including Nordita, the legendary all-Scandinavian Institute of theoretical physics in Copenhagen founded by Niels Bohr. The colleagues from Nordita wanted to negotiate with us some organizational issues in Copenhagen. Bir-gitta knew more about them than I, so we went to Copenhagen together. Thanks to Birgitta, the negotiations were extremely successful. Nordita agreed to cover a significant part of the costs and to extend its patronage over the conference. This greatly raised the profile of our conference in the whole of Scandinavia. Serious sponsors support most willingly those who are already supported by other serious sponsors. Thus, our chances of getting additional funds immediately increased. Today, I hardly recall Birgitta's arguments in these negotiations. I do, however, remember a funny episode outside the negotiations which concerns Danish-Swedish cultural differences. At that time I knew Copen-hagen rather well, as not long ago I had been a Nordita professor, living for several years in the Hellerup district of Copenhagen. To impress Birgitta with my familiarity with Copenhagen high life, I invited her for lunch at the trendy and chic 'Den franske Café'. It was May, the city smelled like crazy with the green lilac, and all tables at the Café were occupied. We sat at the bar and spoke English with a Danish barmaid. We ordered Elephant beer and we both drank a small sip. "Oh, it's very strong", said

Birgitta, clearly surprised. “You must be Swedish!” replied the barmaid immediately.

Everything went well, and our conference “Non-Linear Phenomena in Accretion Discs around Black Holes” took place in Iceland during the summer solstice in 1997. Only what’s best will do! Indeed, we invited only the world’s top experts as lecturers. They all came. Their excellent lectures, edited by Gulli Björnsson from the University of Reykjavik, Jim Pringle of the University of Cambridge and myself, were published a year later, by the prestigious CUP (Cambridge University Press) in a volume “Theory of Black Hole Accretion Discs”.

I flew to Iceland two days before the conference. Birgitta had already been there for a few days to check and prepare everything on the spot. She picked me up at the airport and drove to the conference site. She decided that she needed to have a rental car at her disposal in order to carry our VIPs, and also as a precaution, since the conference hotel was far from the city. Her car was impressive and lovely. I do not remember the make, and I like to think that it was a dark blue Saab convertible. The mountain road ran along the coast in an incredibly beautiful Icelandic landscape, unlike anything I had seen before except, perhaps, for some views that I remembered from Sicily, in the Etna massif. It was just before midnight, or perhaps just after, and we drove in the harsh light of the sun low over the horizon. I was very tired after a long flight across the Atlantic, but even more so affected by this unreal time, neither day, nor night, and the lunar landscapes of Iceland. Every now and then my mind was falling into a shallow sleep and waking up again even more confused. Birgitta drove fast and was clearly enjoying it. The drive felt surreal. Birgitta kept talking, reporting on what she had prepared in the hotel: the deployment of participants in the rooms, arrangements in the lecture room, times for meals. Although her voice was only vaguely reaching my confused mind, the clear and solid reporting of Birgitta was my only grasp on reality in this lunatic journey. Sixteen years later, I still remember this extraordinary Icelandic midsummer night’s dream!

I should not forget to mention the Landau Meetings, where physicists including Americans and Russians met to discuss new developments in physics. The political relations between East and West improved after the death of the Soviet leader Josef Stalin and Western countries began to consider



The audience at the meeting arranged in connection with a visit by Alexander Polyakov (lower right) in October 1976. Sudhir Chadha takes a short cut. Other participants were David Gross (second to left of Polyakov), Alan Luther and Gordon Baym (behind Gross), and Carsten Peterson (shirt with square pattern).

collaboration with the USSR following the takeover by Nikita Krushchev (Soviet leader 1953-1964), who started a de-stalinization and made some liberal reforms.

At a meeting in Geneva 1956 the foreign minsters of the USSR, USA, France and the UK discussed a programme for increased contact with the USSR. In 1958 the US and Soviet governments signed an agreement for bilateral activities, in particular visits in the fields of education, culture and information, including an interacademy exchange programme to be worked out by the academies in the two countries. For a number of years there was a series of meetings on theoretical physics arranged by Professor David Pines (University of Illinois). The Soviet invasion of Afghanistan in 1979 and the internal exile of the physicist and dissident A. Sakharov, who was a member of the US National Academy of Sciences, in 1980 created a hostile atmosphere and the USA terminated many of the two-year programmes that

had been running.⁷

The Niels Bohr Institute had had an agreement on cooperation with the USSR since 1962 and Nordita was seen as a part of this agreement. Apart from the visitor programme, Nordita had arranged two successful meetings in collaboration with the Landau Institute including physicists from the USA and Europe in 1978 and 1980. In August 1980 Professor Aage Bohr wrote to G. K. Skriabin, the Scientific Secretary General of the Academy of Sciences of the USSR, in order to establish a regular connection, with annual seminars, workshops and visits. To arrange future meetings he requested that physicists from Copenhagen, Alan Luther, H. B. Nielsen and C. J. Pethick, be invited to visit colleagues in Moscow to discuss these matters further. These negotiations went well and Nordita took over the arrangement of these meetings in collaboration with the Landau Institute.



The 80th birthday celebration for L. D. Landau, July 1988. Front row, from left, Aleksei Abrikosov, Rudolph Peierls, Philip Anderson, Mitchell Feigenbaum and Alan Luther: Second row, Pamela Davis (wife of Steven Kivelson), Stefan Rozental, Jens Bang, Johannes Hansteen, and Knud Hansen: Third row, David Pines and Ben Mottelson.

⁷National Research Council, 'Scientists, Engineers, and Track-Two Diplomacy: A Half-Century of U.S.-Russian Interacademy Cooperation'. (Washington DC, The National Academic Press), pp1-14 (2004), <https://doi.org/10.17226/10888>

Professor Alan Luther, together with other local physicists and Professor I. M. Khalatnikov, director of the Landau Institute, arranged eleven Landau Meetings in the period 1978-1990. The first meeting in 1978 ('Workshop on Electronic Properties of One- and Two-Dimensional Conductors') was organized by Alan Luther and C. J. Pethick in collaboration with the Landau Institute. Many participants scheduled to attend the USA-USSR Academy joint meeting participated. As a result, a conference of high scientific content and interest was possible. The collaboration with the Landau Institute continued with less bureaucracy into the 1990s and thereafter.

Some of these meetings were arranged in collaboration with the Niels Bohr Institute, others with institutes in Sweden (Chalmers Technical University in Gothenburg and the Swedish Academy of Sciences). Five meetings took place in Copenhagen, two in Gothenburg, and four in the Soviet Union. The Nordita group included physicists from the USA, the Nordic countries and Europe in general. All participants going to Soviet Union had to be approved in advance by the Soviet authorities, a rather time consuming process. Finn Ravndal describes his experiences as a participant in two of these meetings:

Experiences at Nordita–Landau Meetings in the 1980s

Finn Ravndal

At this time Alan Luther belonged to the expanded faculty at Nordita. His relaxed and inspiring personality was appreciated by everyone. For some reason which I never understood he was also central in the contacts between Nordita and the Landau Institute in Moscow. This was at that time one of the few official, scientific contacts between the West and the Soviet Union. The high-level arrangements were worked out by Aage Bohr who had official contact with the Academy of Sciences in Moscow. But in practice it was Alan who made these exchanges really happen and had personal contacts with all the participants on both sides. Originally they were concentrated around condensed matter physics which at that time came to overlap more and more with theoretical high energy physics.

After a first meeting in Copenhagen in 1980 it was decided that a Western delegation should go to Moscow in May 1981. I was one out of seven Nordic physicists together with a handful from France and the US. We met in Helsinki where we held a short seminar and flew the next day on to Leningrad where we

were received by our Russian hosts. This was an exchange approved at the highest levels which meant that we could enjoy the luxury others only could dream about. But in spite of that we were advised to bring with us our own toilet paper and rubber sink plugs! The most appreciated valuta in addition to dollars were Western blue jeans which we could make a fortune from!

In Leningrad we were lodged in Hotel Moskva, very central and the best in town! It looked new and modern. In the room there was a TV which I immediately turned on to get a feel for the place. It had five channels. One with some kind of news, one with sport results, one showed a film from WWII, one presented a report from a successful factory and the last gave a highly advanced lecture on algebraic geometry! That warmed my heart!

From Leningrad we went with the night train in single sleeping cabins made in red velvet with gold trimmings and discrete servants sneaking around. In Moscow we met our Russian colleagues who followed us to the rather gray and boring Akademy Hotel where we were staying the following days. Wherever we went we also had more anonymous persons around us in addition to the official guides. We knew that we were constantly under observation and acted accordingly the best we could. The days were filled with talks and more informal discussions, fueled by Russian dishes and often vodka and cognac in large quantities. Socially I spent most time with the younger Dmitri Diakonov and Lenja Gribov. Dmitri became later a professor at Nordita, while Lenja, who died in a tragic mountaineering accident a few years later, was the son of the famous physicist Vladimir Gribov.

On the evening of May 10 some of us were gathered in one of the hotel rooms, discussing and following the election of Mitterand as the new president in France. That was being celebrated and East-West politics became a hot topic. We knew that our room most likely was electronically bugged, which restrained the debate somewhat. The older Gribov was also present and became more and more outspoken against the Soviet system and the danger it posed for Western Europe. How could he dare to be so critical? Later we were told that he was so highly respected and influential that he could not be touched. But he was also very critical towards persons like me who had been engaged in demonstrations against the planned deployment of middle-range nuclear weapons by NATO. Some months earlier I had been to the prime minister's office in Norway to hand over a list of protests from

faculty members of the University in Oslo. According to Gribov, we were dupes who were manipulated by the communists and made the world even more unsafe. That was a real eye-opener!

Together with a couple of American colleagues we planned to join a refusenik seminar on the Sunday when there was nothing else on the official program. It was supposed to take place in an apartment somewhere in the city. At that time there were no good maps of the city. Those we had were only topologically correct. When we arrived, the entrance to the building was already blocked by a group of young men similar to those who always seemed to be around us. But the organizers of the seminar told us that it would instead take place in another apartment in a different section of the city. They knew that it would take the secret police authorities so much time to regroup, getting new orders etc, that we would have plenty of time for the seminar the rest of the afternoon. And that turned out to be so. We had a very pleasant meeting with some of these refuseniks who had been left out in the cold by the system and longed for human and scientific contact with the outside world.

Another reminder of this shadow world of surveillance and oppression I had a few days later when I alone went into the city center to look around a bit on my own. Since we didn't have much access to Western news, I decided to get hold of the best thing available, namely the newspaper 'Neues Deutschland', the official organ of the East German communist party. But at least it was made in Berlin so maybe with some hints about what was happening elsewhere. As I was waiting in line to buy it at a kiosk, a very nice and friendly person behind me asked me if I was a tourist and what I was doing in Moscow. He was also a tourist, he told me, and had the afternoon free. Perhaps we could do something together? I was certainly somewhat suspicious, but at the same time I've always tried to have an open mind so we started our sightseeing tour together. We were not so far from the Tretyakov Gallery so we went there although I already had been there with the physics group. My new acquaintance gave me a very interesting, guided tour around the different collections of art there. He spoke perfect English without the accents I knew from our Russian colleagues. When I asked him about his background and what he was doing in Moscow, he told me that he was just released from the Russian Army after two years of obligatory military service. That did certainly not explain why

his English was so good. But when I asked him why, he could tell me that he came originally from Kiev where he had played in a symphony orchestra and traveled much abroad. And soon he revealed that in the military he had been stationed as a guard in a camp for political prisoners. If that was not enough, he told me that he had smuggled out photos which he wanted to show me and which I possibly could get to the West!! As a Ukrainian, he hated the Russians! At this stage I really became nervous and came up with the excuse that I had to return to my own hotel. I didn't feel threatened in any way and couldn't really believe that I was set up for a KGB trap. In addition, he was so friendly and likeable that I also tended to believe his story. As I was curious to find out what was happening, I then wanted to test him. From an earlier visit I knew that in the basement of the big Hotel Rossiya not far away from the Kremlin there was a discrete 'dollar store' where tourists with Western money and top party members could buy things which otherwise were not available. Pretending that I didn't know where it was, he told me that he could show me right away! How could a music student from Kiev who had arrived in Moscow the day before after two years in the wilderness know about this particular store? Then I was convinced that he must belong to the KGB and immediately left him without any further problems. Later I realized that if this really was a trap, why would he then have divulged this insight? I will probably never know who he was. And this episode was just one of many other strange incidents we experienced.

One of the last days we were there, we could enjoy one of the first, really warm spring afternoons. Again I was with a few other physicists in central Moscow which for the first time in the early evening was filled with Muscovites strolling around in the pleasant weather. We were told that there was not so much else to do there if you went out. But then suddenly towards nine o'clock we started to see a lot of police and militia groups moving people around. It soon became clear that we were all commandeered down into the metro system in order to leave this central area of the city. It was later said that the authorities were nervous of having such a large number of random people assembled for something which had not been already planned and organized by themselves.

After almost two weeks in Moscow we flew back to the West. When we landed in Helsinki, I almost kissed the ground out of

thankfulness that we finally were back. The last contributions to this East–West scientific collaboration were provided by some of my co-travelers who secretly brought with them manuscripts by our Russian colleagues that they wanted published in Western journals. I think it was Lars Brink who carried the important paper by Alexander Polyakov on two-dimensional conformal field theories for phase transitions and string theory.

When I again was asked to participate in a new visit to Moscow in 1989, I didn't hesitate to go. It turned out to be the last East–West exchange Nordita arranged of this type. It took place in mid-October that year and the occasion was an anniversary around Landau's birthday and the foundation of the institute bearing his name. This time the visit was just a week long and we flew directly to Moscow. Politically it was a very tense time, the communist system in Eastern Europe shaking in its foundations. In Poland the Solidarity movement had taken over the government and Gorbachev had just returned from his tumultuous visit to East Berlin where the communist government tried to fight back against demonstrations all over the country. What met us in Moscow made clear that also the Soviet Union itself was in great difficulties. In particular the general infrastructure seemed to be crumbling and people had great problems in finding sufficient food in the stores.

In spite of that, the main anniversary dinner should take place one evening in one of the best restaurants in the city, in the 'Kiev'. We had often little idea about what was happening around us so it didn't surprise us that we arrived much too late for the dinner. Maybe that was the reason why we couldn't enter through the ordinary entrance, but were instead smuggled in via a kitchen and through a secret entrance in the wall directly into the main dining hall! And there was nothing but chaos! Most of the guests were probably scientific prominences with their ladies. The dining seemed to have just ended and what was left of the food, was on a long buffet table in the middle of the room. Many of the ladies were there hoarding the remains in plastic bags they seemed to have brought with them. All this happened in a cacophony of voices which seemed to have little relevance to the official celebration. When we came in, greetings from foreign dignitaries were presented. I noticed in particular Edoardo Amaldi who tried to convey congratulations from the Italian Physical Society, but nobody seemed to listen or take any

interest. He died unexpectedly just a few weeks later.

This struggle for survival we also noticed when we came to Leningrad on the way back to Copenhagen. When we there said goodbye to our Russian colleagues, many wanted to know about job possibilities and openings in the West, handing us CVs and publication lists. But at the same time, when I tried to give them the latest issue of *Der Spiegel* and some Western newspapers I had brought with me, they didn't dare to take them. So it was a rather scary situation and nobody knew what would happen next, there or in East Germany. Again I was glad to return to a more peaceful country.

It was in connection with one of these meetings that a member of the Nordita contingent, when checking in at Moscow airport, realized he had forgotten his passport at the hotel. There was not enough time to fetch it and return to the airport, so one of the Russian participants, Kolya Nikolayev, was given the task of getting the participant on a plane the following day, Sunday. This was far from easy, as Kolya described in a letter to Alan Luther. Kolya had, first, to persuade the receptionist at the hotel to provide one more night's accommodation and, second, to get a ticket. As the original ticket was a group ticket at a special price, the cost of a new ticket just from Moscow to Helsinki, was DKK 1840 to be paid in foreign currency. After a long explanation, payment in rubles (186) was allowed. Fortunately Alan Luther had established a small fund to be used for possible extra expenses and this covered the hotel and the ticket. However, the flight from Helsinki to Copenhagen could not be paid for in rubles, so this part of the return journey was solved with the help of Helsinki physicists. Thereafter Kolya and the participant went to the International Telephone Station to make a call to the participant's family. Here the answer was that the line was very busy, but one could book a call for Tuesday! Again Kolya had to use all his charm to persuade the lady, and after half an hour the call went through.

The visitor programme, meetings and conferences were instrumental in creating the basis for cooperation and networking, often lifelong, among the physicists. Regis Cabral describes the influence of Nordita and some Swedish institutions in the creation of networks with Latin America.⁸

In 1995 the Board introduced Nordic Projects. A group of Nordic researchers, including at least one from Nordita, worked on a common project and were allocated funds to visit Nordita, invite visitors and arrange workshops and meetings. One had to send an application describing the project

⁸Regis Chabral, 'Latin America, Spain and Portugal: Scientific Networks and Exchange with Sweden', *Science Studies* **5**, 97 (1992).



A session at the first Master Class in 1997.



Participants at the Master Class in 1998.

and include a budget. The Nordita Board decided which projects to support. Up to 2006 two to seven projects were approved per year, the average being five.

Two more initiatives were taken in 1995 and 1996. The Nordic-Baltic Committee to support and initiate cooperation with the Baltic countries and neighboring areas. Nordita organized some meetings in cooperation with physicists from the Baltic countries and received a special grant for Baltic/NW Russia fellowships of up to 18 months' duration, with most fellows receiving three months. A few years later the generous support from EU, the Nordic Council and other organizations to the Baltic countries and individual physicists far surpassed the limited resources of Nordita.

Another innovation was the Education Committee, with the purpose of developing Nordita's educational role and Nordic collaboration in physics education. This was the beginning of the Nordita Master Class in Physics, where some of the best Nordic and Baltic undergraduate physics students were introduced to frontier physics topics presented by top scientists at an understandable level. These meetings were very successful and were continued in the following years.

The Institute Spirit

As in most workplaces, working at Nordita was not just work, it was also a cultural and social 'gemeinschaft' and the social aspect was supported in several ways. This was one of the things inherited from Niels Bohr.

Niels Bohr spent part of the years 1911-1912 in England, the last part at Manchester University, where he studied at the eminent physicist Ernest Rutherford's laboratory. He wrote to his fiancée Margrethe, asking if, in case his plans for an institute came through, she would act like a mother for his students. He would then try to act as a father like his father Christian Bohr had been for so many many students. Margrethe answered that nothing would please her more than trying to be a mother for his students.⁹

We know from several reports and memos that this was how the institute worked. Niels Bohr had an interest in people's well-being beyond their work in physics. In 1956 Niels Bohr was part of an initiative to secure inexpensive flats for Danish and foreign students working at the institute. Two large companies, Burmeister and Wain and the East Asiatic Company, paid DKK 20,000 each to secure two flats at the combined hall of residence and hotel Solbakken (close to the Carlsberg Breweries) for physicists and Nakskov

⁹F. Aaserud, in 'Bohr på ny', ed. Lone Bruun, Finn Aaserud og Helge Kragh, (ForlagetEpsilon.dk, 2013), p. 55, ISBN 978-87-995114-4-0.

Shipyard offered to furnish one of the flats. In his letter of thanks to these contributors he expresses his gratitude for the big contribution “which will be of special importance to our circle, where we very often have had difficulties in finding good lodging for young Danish or foreign scientists, who take part in the atomic physics studies and investigations at the institute”. Finding housing is still a problem today.

In an interview, his wife Margrethe described his working methods: “He worked hard, also in the evening and as a rule with an assistant. His collaborators were very important to him as his method of work was the dialogue, a discussion. He himself was a very harmonious person; in return he could only work with people he was in harmony with. He could not be comfortable if not surrounded by harmony. This automatically led to the collaborators becoming good friends, and many of the foreign students were happily surprised by the open, confident atmosphere at the institute. This was not what they were used to.”¹⁰

An impression of the style at the Institute and Niels Bohr’s personality is given in an interview with one of Niels Bohr’s close collaborators, the Dutch-born American physicist Abraham Pais, who was at the Institute in 1946-47 and a frequent visitor thereafter.¹¹ As Pais says, “The environment of the institute was at the same time very serious and easy and cheerful. Bohr had a distinct sense of humour. His authority was never external or affected, but a part of his personality. . . We did not just respect him, we loved him. One did not have to waste time with formal courtesy but could talk to him straight out. He could look unhappy if one claimed not to believe in a statement, but listened and if one were right he agreed. If not he would also say so, but always in a very kind way, like ‘this is very interesting’. Those who knew him were aware that a minute after would come the fatal ‘but’ followed by an explanation that revealed that he did not believe a word of it. Another of his standard comments was ‘we are much more in agreement than you think’. Insiders knew that the translation of this comment was ‘we are deeply in disagreement’.” The Copenhagen spirit is described as the free and open discussions of any subject that would arise. The social foundation for this was the young physicists’ temporary visits, and their discussions among themselves and with Bohr.¹²

A special feature of the institute was the considerable number of scientists from abroad included in the research programmes there. When Niels Bohr wrote his application for an institute his model was the new institutes,

¹⁰Margrethe Bohr, Interview by Ninka, Politiken, 8 March 1970.

¹¹Abraham Pais, interview by Marianne Juhl, Weekendavisen, 1 June 1990.

¹²F. Aaserud, in ‘Bohr påny’, ed. L. Bruun, F. Aaserud, and H. Kragh, (Forlaget Epsilon.dk, 2013), pp. 58-64, ISBN 978-87-995114-4-0.

especially in Germany, where the study of theoretical physics was combined with the possibility of experimental work and tests. These institutes, directed by excellent scientists (Max Planck in Berlin, Arnold Sommerfeld in Munich) were extremely successful and attracted many researchers from abroad.¹³ Niels Bohr found that an institute like this in Copenhagen would be vital for the education within physics and at the same time could support international cooperation within physics at a time (1921, just after WW1) when many European countries suffered from the costs of the war, and the unbearable conditions for peace for Germany, which made it impossible to continue the scientific progress that took place before the war. In order to finance the establishment of the institute, a private committee of wealthy people was established and this succeeded in collecting funds for both the land and the building.

In the following years Niels Bohr continued to apply for funds to expand the institute and cover the expenses in connection with scientists visiting the institute. He applied to private sources like Carlsberg and the Rask Ørsted Foundations. The International Education Board (IEB), established in 1923 by funds from Rockefeller, also played a great role. This foundation supported the best scientists and institutes in Europe and Niels Bohr's institute was the first to receive support.

From its modest start in 1921, the institute very rapidly developed into a centre of modern atomic physics, with visits by some of the best young physicists in the field from many foreign countries. This was mostly because of the reputation of Niels Bohr as a leader within this field, but also because Denmark had been neutral during the war and now could serve as a meeting place for physicists from both sides.¹⁴

For a sense of the spirit of the institute in the 1960s let me quote Bent Sørensen, who studied at NBI then and was a Nordita fellow in 1965-67:

As an MA student I was offered office space in the S-building in 1963. Niels Bohr had died the year before, the institute was continued in his spirit with his son Aage Bohr as head of the institute. This implied strong international cooperation and openness for researchers from all countries including East European countries. The Bohr family also showed openness for new thoughts in many other areas. Niels Bohr had taken a personal interest in practically speaking everything that took place at the institute, including reading and correcting all scientific articles by the researchers at the institute. Aage Bohr also showed a warm

¹³Ref. 11, p. 43

¹⁴Ref. 11, p. 56.

interest in the quality of the scientific work, but was not afraid to delegate responsibility to the scientific staff of the institute. The core for both was a deep interest in the professional and personal development and well-being of the young as well as the older employees.¹⁵

Another research student at NBI at that time, Preben Wilhjelm, explains in his book the difficulty in getting a visa for the US, where he had been offered a one-year fellowship at Duke University, starting in September 1966. Since the visa application process was long, he had no income for two months. During this period he continued to work with his experiments at the institute. He was contacted by several researchers who, like him, had had problems in getting a visa to the US. This came as a surprise for him, as he knew these colleagues to be apolitical, but he realized that the NBI was looked upon with scepticism by the Americans, as the openness for physicists from all over the world, including the east block and China, made the Americans suspicious. According to him this openness, especially during the Cold War in the 1950s and 60s, made the institute a unique place in the researchers' world.¹⁶

Normally Danish researchers visiting the US would apply to NATO for their travelling expenses. Wilhjelm, with his politically left-wing opinions, would hardly ask NATO for support. Aage Bohr, head of the NBI at the time, contacted Wilhjelm about the travel arrangements, explaining that he realized Wilhjelm might not want to apply to NATO and Wilhjelm confirmed that he would pay the travel expenses himself. Aage Bohr understood this viewpoint, but wished, if Wilhjelm would not object, to offer him a grant from the Niels Bohr Foundation to cover the travel expenses. One could not apply for this grant, but he would suggest to the chairman of the Niels Bohr Foundation (Stefan Rozental) that Wilhjelm should receive it, and so it was.

Preben Wilhjelm writes, "I found and still find that this was an example of incredible care. I received the Niels Bohr grant in 1966 and I can guarantee that it was not because I was scientifically the best choice; there were several others much better than me. No, this was because Aage Bohr, one of the most able scientists in the midst of his busy and deeply engaged scientific thinking, had thought of one of his former employees without salary for two months and maybe silly enough not to apply for NATO support. This was

¹⁵Bent Sørensen, 'Physics Revealed: The methods and subject matter of physics, an introduction to pedestrians (but not excluding cyclists)', Part III, IMFUFA text 392, (2001), p. 8, ISSN 0106 6242.

¹⁶Preben Wilhjelm, 'Fra min tid', (Gyldendal, Copenhagen, 2005), pp. 85-95, ISBN 87-02-03618-5.

not fair and a solution had to be found. This was the spirit of the place.”¹⁷ This spirit was also supported by the fact that the foreign researchers might need assistance in order to manage everyday life in Denmark, especially in those days when international travel was less common. The administrative staff at the institute offered assistance in finding accommodation for visiting scientists and their families, making visa applications, contacting the authorities about taxation - a rather tricky business - and other problems. New employees from abroad were told to contact the administration if there were problems with authorities, housing, banks or other local difficulties. If serious problems came up we could always count on our legal advisor Leo Nielsen to assist in finding a solution.

In those days the two institutes Nordita and NBI were housed in the 4 buildings, A, B, C, and K, plus two wooden barracks, one at the back of the institute and the other in front. During the summer the one in front had roses and clematis covering the side facing the street. The staff and visitors at NBI numbered about three times those at Nordita.



The B and C buildings in the 1980s.

¹⁷Ref. 16, p 95.

The lunch room was shared. Until the mid 1970s, it was situated in the top of the C building and physicists and administrative staff had lunch together. At that time the selection of food was very limited: boiled eggs, rye bread with butter, and bread with cheese, milk, tea and coffee. Most people brought their own lunch or went across Blegdamsvej, where at that time there was a shop selling open sandwiches.

During lunch all kinds of topics were discussed. Physics, of course - as a rule there were paper and pencils on each table and, if the paper had been used up, napkins would do to scribble a formula - but also politics and other matters of general concern. Personally I remember Preben Wilhjelm (later a member of the Danish parliament) collecting signatures to run for parliament, J. R. Schrieffer talking about eye or voice identification instead of keys, and what would happen if you had a cold and your voice was altered, Léon Rosenfeld listening while eating his standard lunch of one soft-boiled egg, one slice of rye bread with butter and one open sandwich with cheese, Ricardo Broglia discussing politics, Hans Bethe surrounded by listeners and the fellows interacting with other physicists, fellows and secretaries sharing jokes and stories. There was always some discussion going on and in order to keep the noise at an acceptable level the ceiling was covered by egg boxes painted green, the same colour as the chairs. This special use of egg boxes was invented by Sven Holm, engineer and head of the NBI administration at that time. While moneywise the institute was not rich, ingenuity was abundant.

In the C building the present Auditorium B, the room next to Auditorium A, was an institute lounge, operated by a fund established in the memory of Dr. Charles Gallagher. It was open to all members of the institute and contained a wide selection of newspapers and magazines, as well as a TV set, a radio, maps, playing cards, chess, etc. The lounge might also be used for various kinds of evening activities, e.g., bridge, chess, music etc.

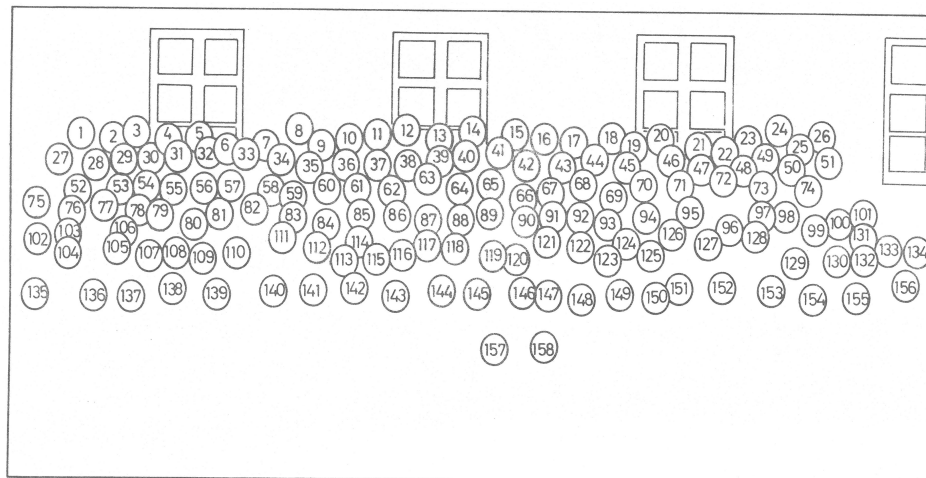
In the late 1970s the lunch room was moved to the F building, which had become part of the Niels Bohr Institute after RECKU moved. The selection of lunch dishes was increased and even included hot food and espresso machine was installed.

In connection with the new lunch room, a smaller room on the same floor was converted into a reading room, with a vending machine for coffee, newspapers and a few physics journals. Nordita ordered the Finnish newspaper 'Helsingin Sanomat' as part of the newspaper collection.

In the afternoons the secretaries and others had a tea break around 3 pm. When I started, this break was in the lunch-room, but often it took too long because I found it hard to leave the interesting company almost impolitely. Later the Nordita staff had a common room in the Nordita building where



The 1979 group photograph of NBI and Nordita. Predrag Cvitanović was travelling, so Kirsten Luther drew the picture of the cat to ensure that he was represented.



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|---------------------------|----------------------------|-------------------------|--------------------------|--------------------------|
| 1. Francesco Catara | 33. Einar H. Gudmundsson | 65. Benny Lautrup | 96. C. V. K. Baba | 128. Erik Christensen |
| 2. Erik Rüdinger | 34. Jussi Timonen | 66. R. C. D. Horsley | 97. Jose Maria Carcione | 129. Ruth Møller Jensen |
| 3. John Negele | 35. Ole Ulfbeck | 67. Paul Lauwers | 98. Enrico Maglione | 130. Lise Vistisen |
| 4. Naoki Iwamoto | 36. Knutur Arnason | 68. S. G. Downes-Martin | 99. Helle Roy-Poulsen | 131. Ragnar Møllerud |
| 5. Mogens Willumsen | 37. Sigurdur Magnusson | 69. Hiroyuki Sagawa | 100. Allan Christiansen | 132. Per Rex Christensen |
| 6. Grethe Møller Nielsen | 38. Jerzyk Szlenki | 70. Jens Syrak-Larsen | 101. Johannes Madsen | 133. Alex Nielsen |
| 7. Bente Scharff | 39. Mikael Rattenberg | 71. Jerry Garrett | 102. Ove Nathan | 134. Viggo Voetman |
| 8. Jan Myrheim | 40. Peter Husby | 72. Carsten Peterson | 103. Charles R. Alcock | 135. Jytte Sørensen |
| 9. Inge Søndergaard | 41. John R. Hansen | 73. Henning Espensen | 104. Leon Mestel | 136. Elsebeth Vinther |
| 10. Pawel Haensel | 42. Lars Henrik Olsen | 74. Stephen Libby | 105. Håkon Olsen | 137. Vivian Clifford |
| 11. R. N. Hills | 43. Peter N. Scharbach | 75. Åke Nordlund | 106. Flemming Videbæk | 138. James Hamilton |
| 12. Ole Bakker | 44. Henrik Flyvbjerg | 76. Jørgen Boggild | 107. Ruth Almegaard | 139. Stefan Rozenau |
| 13. Henrik Vidberg | 45. Holger Bech Nielsen | 77. Luiz N. Oliveira | 108. Ulla Holm | 140. Aage Winther |
| 14. Paul H. Roberts | 46. Holger Straadt | 78. Katsuhiko Sato | 109. Lise Madsen | 141. Ricardo Broglia |
| 15. Peter Minnhagen | 47. Torgeir Engeland | 79. Xu Zhan | 110. Bitten Brøndum | 142. Mogens Pihl |
| 16. Masao Ninomiya | 48. Keith Jones | 80. Chen-Li Wu | 111. Chris Pethick | 143. Aage Bohr |
| 17. Andras Patkos | 49. Christofer Cronström | 81. Chen-Li Tiang | 112. Nils Robert Nilsson | 144. Torben Huus |
| 18. Jan Magne Leinaas | 50. Jens Tscherning Møller | 82. Søren Pontoppidan | 113. Agnetha Elvings | 145. Ben Mottelson |
| 19. Ryu Sasaki | 51. Carl Gaarde | 83. Per Høj Christensen | 114. John Hooper | 146. Birthe Lenschau |
| 20. Bjørn Fjelsager | 52. Anna Zytkow | 84. Claude Guet | 115. Vera Rothenberg | 147. Bonna Madsen |
| 21. T. Koikawa | 53. Vladimir Zelevinsky | 85. Rainer Lieder | 116. Ingrid Kjems | 148. Sven Holm |
| 22. Erwin Perl | 54. Hanne Bergen | 86. Sven Bjørnholm | 117. Trent Lee Nichols | 149. Niels Ove Lassen |
| 23. Niels Henrik Bastholm | 55. Helle Kiilerich | 87. Shalom Shlomo | 118. Mike W. Guidry | 150. Knud Hansen |
| 24. Jørn Dines Hansen | 56. Børge Madsen | 88. Young-Shou Chen | 119. Inger Wadil | 151. Alan Luther |
| 25. Ritta Nielsen | 57. Jens Jørgen Gaardhøje | 89. Da Hsuan Feng | 120. Eva Hansen | 152. Otto Kofod-Hansen |
| 26. Niels Beene | 58. Mikhail Zhukov | 90. Jens Bang | 121. Igor Mishustin | 153. Bent Sørensen |
| 27. Phil Siemens | 59. Gen-Ming Chin | 91. Björn Nilsson | 122. Carlos Daso | 154. Lens Raundorf |
| 28. Antonio Insolia | 60. Madappa Prakash | 92. Hans Boggild | 123. Gudrun Hagemann | 155. Lise Juel |
| 29. Jørgen Kalckar | 61. Asko Karvinen | 93. Henny Bork | 124. Sven Ølgård Nielsen | 156. Mogens Wolf Hansen |
| 30. Jan Fischer | 62. Gitte Hass | 94. Arne Lindahl | 125. Tove Trinnerup | 157. Rikke Lenschau |
| 31. Bruce Goodwin | 63. Claus Borggaard | 95. Georg Sidenius | 126. Torben Bech | 158. Liselotte Andersen |
| 32. C. Fransson | 64. Vibeke Eider | | 127. Ole Holck | |

we met; very often a few physicists joined us and the conversation. We had great fun when we were trying to explain Danish words or pronunciation to people from abroad. When our Russian visitors were about to leave they often gave a farewell party with vodka and caviar. We also had a cup of coffee in the morning, and again physicists who wished to could join us.

One visitor made a special impression, Professor Alfred Schild from Austin, Texas, who often visited and spent several months at Nordita collaborating with Professor C. Møller. Professor Schild often joined us for the morning coffee. He was always in a good mood and told us stories, e.g., how he played poker on the ocean liner sailing him and his wife to Denmark, claiming that he won enough to buy his wife a mink coat. One day he arrived with a whole bottle of snaps, the Danish dram. He explained that he had had lunch with Møller in Nyhavn - at that time a somewhat rough place with lots of pubs for sailors and not at all surroundings where you would expect to find the fine gentlemen Schild and Møller - and had learned about the Danish drink 'a little black': put a coin in a cup, add coffee until you cannot see the coin and then snaps until the coin is visible again. Of course the snaps was put away in our local bar for another occasion.

A popular professor in the first period was the American physicist Gerry Brown. He was offered and accepted a professorship at Nordita in 1960. From 1964 onwards, he divided his time between Nordita and the USA, Princeton from 1964-68 and Stony Brook University thereafter. He retired from his Nordita position in 1985, but maintained his connection with the institute until his death in 2013. Gerry Brown's way of teaching and acting was very different from what the students were used to. Let me quote

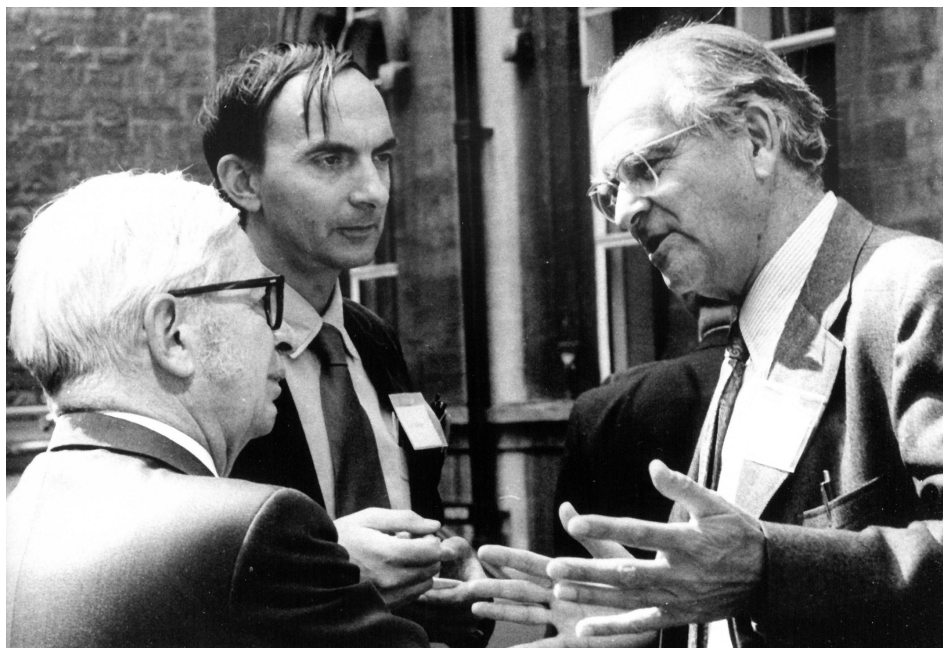
Dan-Olof Riska: “While at Nordita, Gerry played an exceptional role as an advisor and career guide for the fellows, who at that time were mostly graduate students at the universities in the five Nordic countries. By cultivating his informal behavior he was the most approachable for shy Nordic graduate students among the professors at Nordita at that time, and in combination with that his readiness to propose research problems in nuclear and particle physics to any student who showed up, he attracted a large number of graduate students. This role was emphasized by his rapid learning of the Scandinavian languages and some basic Finnish as well.”¹⁸

Colloquia at that time have been described by Bent Sørensen. “About twice a week new research findings were presented at a colloquium. Only researchers with a long experience in keeping track were able to present their results as planned. As a rule the speaker was interrupted by the listeners after a few sentences and questioned about the methods and assumptions used and the result. Gerry Brown was a specialist in making new speakers all flustered. He would arrive after the start of the colloquium and already at the doorstep ask the speaker a question, using the confusion this caused for the speaker to get an idea about the subject from the blackboard and continuing to sketch a possible relation between his question and the subject. This provocation had the same purpose as the other interruptions of the speaker, to test if the speaker had such deep understanding of the subject and understanding of his own thesis and arguments that even a strong provocation could not disturb him. Often this method revealed the central problems and a relevant discussion could start, but at a level where only the listeners who already knew the subject could participate.”¹⁹ Gerry Brown also took part in arranging special events at the institute; when the Bolshoy Ballet visited Copenhagen in 1960 he was one of the organizers of a party for the ballet and the Bohr institute researchers at the Langelinie Pavillion (Langeliniepavillionen).

For several years a New Year’s Eve party took place at the institute. Everybody there was invited to participate with their families. All participants brought something to eat and drink. Gerry brought a baby bath tub with a big block of ice, poured vodka and orange juice in the tub and produced a drink which was very strong for the first arrivals, but later became weaker as the ice melted. In the auditoriums A and C there was children’s entertainment, movie cartoons in Aud. A, and paper cutting and painting in Aud. C. When the children became tired they were put to sleep on a sofa in one

¹⁸Dan-Olof Riska: Archimedes 4, 28 (2013), URL: <http://elektra.helsinki.fi/se/a/0004-1920/2013/4/geraldeb>

¹⁹Sørensen, Ref. 4, p 5.



From left, Rudolf Peierls, Gerry Brown and Victor Weisskopf at a conference at Oxford to honor Peierls, 1974.

of the offices (fortunately almost all offices had a sofa).²⁰ The parties went very well, with food, drinks and dancing lasting till the early morning.

During the period when Christian Møller was Nordita director, the scientific staff and the fellows were invited to dinner at least once per year. Matts Roos, one of the Finnish fellows, describes a dinner party at Christian Møller's home where one was taught how to clip a cigar the right way. Professor Møller and his wife also invited all fellows and staff to afternoon tea and cakes in their home. Møller's successor as director, the astrophysicist Bengt Strömgren, invited all Nordita staff and fellows to a buffet at his home once a year. Since he had been granted the Carlsberg House of Honour

²⁰When the Mathematical Institute (part of the NBI complex and from 1964 the Nordita building) was opened, the institute was presented to the press and Professor Harald Bohr explained that, contrary to the theoretical physics institute with strange technical installations, only smaller blackboards for the private use of the individuals would reveal that mathematicians were to be housed here. He continued, "But we hope that the offices are adequately equipped for their purpose, and to prepare you for what you are about to see, I may be permitted to quote what an excellent American mathematician said to me as he showed me the mathematical institute of his university, 'After all the most important external facility for a mathematician is a sofa, and perhaps a waste-paper basket'". (Harald Bohr, 1934, MS, pp. 4-5)



The Nordita team.



In the foreground Daniel Bes (Nordita) and Erik Rüdinger (NBI).



Shots from the Nordita–NBI football match in 1965.

as his home after his return from the USA, he could accommodate all staff, fellows and visitors at the same time. Later ‘potlucks’ became an annual event in which every participant brought a dish from his or her homeland. The food was prepared and heated in the canteen, and wine and beer could be bought. It was fun to taste Japanese sushi (before it became fashionable), Russian canned dried fish, Finnish bread with dried fish, frikadeller, many different spaghetti dishes, Chris Pethick’s Christmas pudding with custard, etc.

For several years there was a football match in the summer between Nordita and NBI. The goalkeepers were Aage Bohr for NBI and Ben Motelson for Nordita. The matches were so professional that passers-by stopped to watch. It could be difficult for the players to distinguish between friend and foe, so one year I persuaded ESSO, the oil company, to donate 12 T-shirts which they had made in connection with a new campaign ‘Put a tiger in your tank’. It worked fine.

When jogging and running became fashionable we arranged after-work trips to the jogging path in Kirkeskoven close to Holte, bringing along some food. Other trips to the woods or beach were also arranged. One of the more special trips that took place in May, was bird watching in the early morning (5 am) arranged by Jakob Bondorf and Chris Pethick. People would gather at a bus stop close to either Mølleåen or other areas with many birds and walk for a couple of hours listening to all the different birds singing which experts like Jakob Bondorf could identify. The final stop was at the house of a staff member for breakfast.

In early December - not too late as we wanted all the researchers from abroad to participate and many would go back home for Christmas - the NBI served glögg and æbleskiver (doughnuts) in the canteen. For this occasion retired scientific, technical, and administrative staff were also invited and the event was much appreciated by present and former employees.

In the early years Christmas lunch at Nordita was not more than having lunch together, but later it became a big event. Everybody at Nordita and the NBI had Christmas lunch in the NBI canteen. Special Christmas songs were made for this occasion and later there was music and dancing till early morning.

The type of events changed over the years, but there were always some events arranged and apart from planned events, people arranged private parties, common trips to exhibitions or just met to go downtown. In connection with meetings and conferences there were often arrangements where the locals could participate.

THE COMING OF THE BOOK.
(mel.: Yellow Submarine)

In the town
of København
once two fellows met
and one he said:

Let us write
a little guide
to the universe
of nuclei

chorus:
|:We all wait for the
coming of the book,
coming of the book,
coming of the book.:

It can all
be understood
if we just recall
how it was put:

Is she round
she may vibrate
and as often found
also rotate

But take care
behind her calm
with collective charm
she wants to pair.

chorus:
We all wait...

In this way
appeared one day,
1962
notes for you:

Very pri-
liminary
version of the book
by B and M

chorus:
We all wait...

Version two
was ready soon,
treated all except
the sun and moon

Version three
without a plea
- an omission sin
no isospin.

chorus:
We all wait...

And the time
went by and by,
hear the steady chime:
you cant deny

she has grown
and quite forgot
that harmonic song
she used to sing

Now she ne-
ver just rotates,
never dances to
a single mode

chorus:
We all wait...

As a dream
to taste the words
FINAL VERSION but
one or two

B and M,
see both of them
writing on page ten
thousand.

chorus:
|: We all wait for the
coming of the book,
coming of the book,
coming of the book. :|

A Christmas song from the 1960s. (The misalignment is in the original.)

*Blegdamsvejs julefrokostfællesvis***Mel.: Højt fra træets grønne top****Bord 2:**

High above the rest of you
we sit and play with strings
when snaps is flowing in our throats
brilliant are our thoughts.
Black holes, fields we do it all,
all you have to do is call
we are theoreticians
modern world magicians.

Bord 3:

Fifty years have seen us here
working on the frontier
Now it's time to pack our bags
soon we disappear
But our hearts will always be
bound to this community
Bohr has served us well
now we'll work with Nobel

Bord 4:

Højt fra Institutets tag
came those nerds to drink here
og på juleaftens dag
headaches disappear-r-r
Tag nu smukt dit glas i hånd
don't forget to keep "bon ton"
først så skal der skåles
siden skal der skråles

Bord 5:

I den søde juletid
her på instituttet
brændes kort med megen flid
vi er fast besluttet
på at Atlas bli'r succes
Men det eneste vi ve'
at med Higgs'ens komme
flaskerne bli'r tomme

Bord 6:

Her hos Bohr vi nu har fest
alle her er glade
Vi har fået æbleflæsk
fisk med remoulade.
Flæsketeg med rødkål til
flaskesnaps og løg til sild
og nu er vi møre
på vej i uføre

Bord 7:

From the highest green tree top
shining Christmas glitter
Playman play quite merry up
now begins the jitter
Put your little hand in mine
please don't touch my clementine
First the tree will glimmer
then we'll eat our dimmer

Bord 8:

Her vi sidder på Niels Bohr
nyder julemaden
stiller op fra syd og nord
laver larm i gaden
glem nu al strukturdebat
ævl og kævl og andet pjat
For nu starter festen
I må selv om resten

A Christmas song from 2004.

Evaluation and Auditing

Already at the first official Board meeting on October 10, 1957, it was decided to appoint Leo Nielsen as legal advisor to the Board. Leo Nielsen was a lawyer and held a position in the Danish Ministry of Finance. He served as secretary to the Minister of Finance Viggo Kampmann, and had been the financial watchdog in connection with the building of the Risø research establishment, where he became acquainted with Niels Bohr. Leo Nielsen was of invaluable assistance not only in connection with the preparation of documents like governing rules, pension regulations, staff regulations, minutes and decisions by the Board, but also as legal adviser when there were problems in the daily running of the institute. At the same Board meeting an auditor was appointed: Jørgen Bredsdorff, who held a position at the Danish National Audit and later became its head. Nordita's accounts were examined thoroughly every year by the National Audit before distribution to the Nordic Governments and the Board. Alan Luther once signed a receipt 'The phantom' and was duly impressed when the audit picked up that receipt and asked him for an explanation.

After Nordita had been established the next thing was to secure its existence by demonstrating its Nordic usefulness. During the year minutes of the Board meetings were sent to the ministries of education or the national research committees in the various countries and to the Danish National Audit. The minutes included the director's reports made for each Board meeting giving a summary of what had happened at the institute during the period since the previous Board meeting. This continued after the Nordic Council of Ministers took over as the organization responsible for Nordita. Every year annual reports were published; these gave an overview of the activities at the institute, the number and names of fellows, names of visiting scientists (including the institutes they visited and the period of their visits), meetings and conferences (including the number of participants), articles and lecture notes published, and the budget figures. These reports were also sent to libraries at physics institutes in the Nordic countries, members of Nordita committees and, on request, to other interested bodies and individual Nordic researchers. The Board and the authorities in the other Nordic countries also received the annual audit report from the Danish National Audit.

In 1988 the Nordic Council of Ministers arranged an international evaluation of Nordita.²¹ Overall, the report was positive but with a few misinterpretations. In accordance with the recommendations of the report, the

²¹'International Evaluation of the Nordic Institute for Theoretical Atomic Physics: NORDITA', Nord FPR publication no. 9, NORD 1988:105, Nordic Council of Ministers, Copenhagen, 1988.

statutes and staff regulations of Nordita were revised and the Executive Committee was abolished. Some of the recommendations could be accommodated within Nordita's budget. A further recommendation was that a full time director should be recruited by external advertisement, and that the Board should send a proposal for appointment to the Nordic Council of Ministers, who would make the final decision. Since no extra funding was provided, this was first realized with the appointment of Paul Hoyer in 1994 following the retirement of Nils Robert Nilsson and a reorganization of the administration.

It had been obvious for some years that the Nordic Council wanted to reduce its support to the institutions that had been established over the years because a considerable part of its budget was spent on them. The desire was that the host countries of the institutions or other interested parties should take over a greater part of the expenses and that smaller institutions should be closed down in favour of more fixed-term projects. The next evaluation was triggered by the referendums in Finland, Norway and Sweden in 1994 about their future relation to the EU. The Nordic Council and the Nordic Council of Ministers decided to analyse the Nordic cooperation in the light of the new conditions and established a working group of members of the various parliaments and the ministers responsible for Nordic cooperation. The report from the working group recommended a political evaluation of the existing 40 institutes based on 'Nordic usefulness'. This evaluation took place in 1995 and the report was ready in October 1995.²²

Up to this time, Nordita was considered important for Nordic cooperation in theoretical physics and supported by the reports and physicists more broadly. A few years later in October 2003 the Nordic Council of Ministers committee for education and research (MR-U) decided to transfer the Nordic research institutes to a national level and adjust the contract to the legislation of the host country. The Nordic profile of the institutes should be secured by a Nordic Board and results-based contract between the host university and the Nordic Council of Ministers. In March 2004 MR-U decided to carry out an evaluation of Nordita with the aim of evaluating the realistic possibilities for national financial support of Nordita and survey areas of potential interest from the point of view of relevant national partners and organisations. The evaluation was to be made by an international group chosen by a working group appointed by NOS-N (Joint Committee of the Nordic Natural Science Research Councils). This evaluation was presented in December 2004.²³

²²'Nordisk nytte', report from Den Fællesnordiske Arbejdsgruppe, October 1995, Nordisk Ministerråd.

²³Letter with documents from NOS-N dated Oulu, December 19, 2004, addressed to Nordic Council of Ministers, Ref.: Evaluation of Nordic Institute for Theoretical Physics.

About national support it turned out that both Denmark and Sweden were interested in hosting and supporting Nordita. The three possible options were Denmark, a consortium in Sweden, or jointly by Denmark and Sweden. The evaluation committee found the Swedish consortium the best solution, subject to a closer investigation. The final decision was made in April 2005 by Secretary General P. Unckel, who chose to move Nordita to Alba Nova in Stockholm, supported by the Swedish consortium consisting of KTH Royal Institute of Technology, Stockholm University and Uppsala University. Nordita began operating in Stockholm on 1 January 2007.

Chapter 3

Pictures from Nordita's Archive

Nordita's archive contains many pictures of scenes from the life of the institute, some of them taken by professional photographers, others by participants in the events. We have decided to collect a number of these pictures here. There are two reasons for doing this. One is that insertion of many pictures within the individual chapters breaks up the text. The second is that \LaTeX has a very strong will of its own regarding the location of 'floats', such as pictures, and this can be tamed only by a very experienced \LaTeX aficionado.



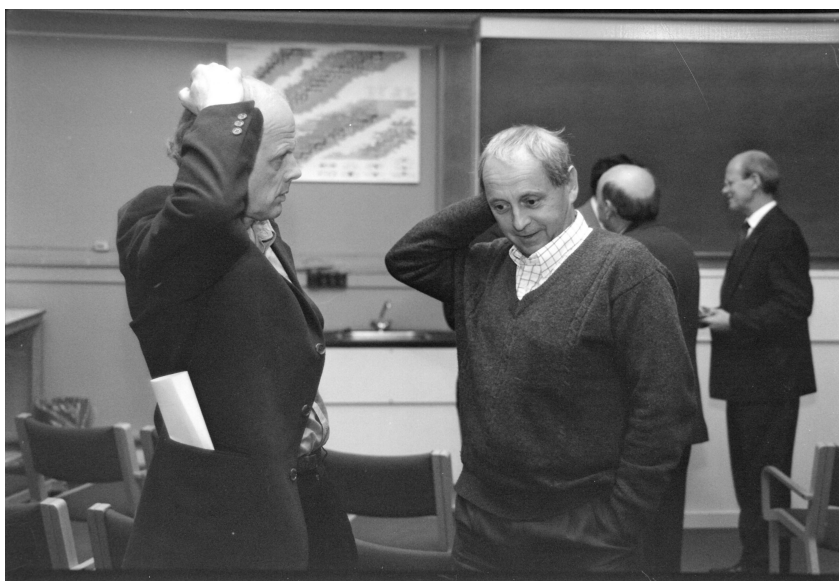
Bengt Strömgren lecturing at Nordita's 20th Anniversary, 1977.



Bengt Strömgren and Ben Mottelson. Nordita's 20th Anniversary, 1977.



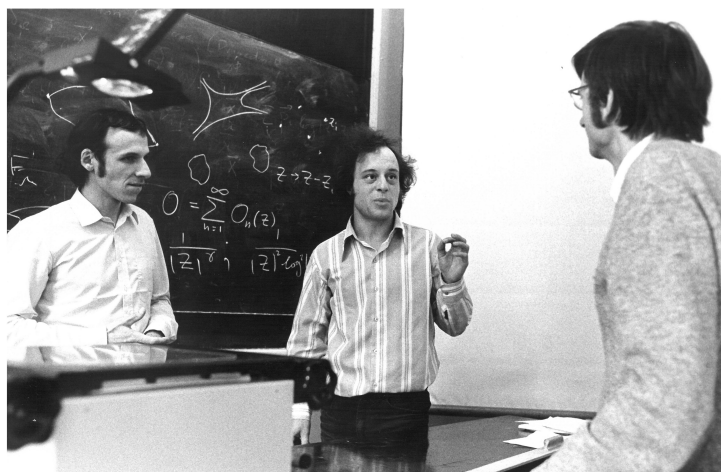
Jens Lindhard and Wlodek Swiatecki. Nordita's 20th Anniversary, 1977.



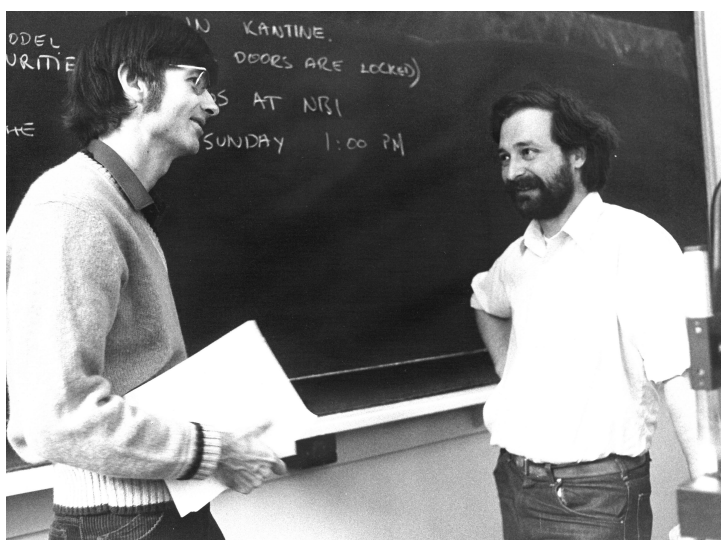
Lars Brink and Sasha Dolgov with I. M. Khalatnikov and Søren Christensen (Secretary General of the Nordic Council of Ministers) in the background. Nordita's 40th Anniversary, 1997.



Among the audience in Auditorium A one can see Philip Siemens, Tomas Bohr, Poul Henrik Damgaard, Antti-Pekka Jauho, Ben Mottelson and Dieter Schotte.



Vladimir Dotsenko (left) with Alexander Zamolodchikov and Alan Luther.



Alan Luther and Eduardo Fradkin.

From the Nordita–Landau symposium in 1978.



Kolya Kopnin and
Dima Khmel'nitskii.



Kirsten Luther, Kolya Kopnin
and Sergei Brazovskiy.



From left, Alexander
Andreev, Anatoli Larkin,
Kostya Efetov, Igor
Fomin (?), Lev Gor'kov,
Sergei Gordyunin, Volodya
Lebedev, Dima Khmel'nitskii,
Georgii Kharadze, Boris
Ivlev, Volodya Mineev, and
Isaak Khalatnikov.

Potluck dinner at the Nordita-Landau symposium, 1980.



Alexander Polyakov expounding at the 80th birthday celebration for L. D. Landau, July 1988. Behind him are Igor Dzyaloshinskii (far left) and Jussi Timonen, and in front of him Alpo Kallio, David Langreth and Abraham Pais.



Aleksei Abrikosov and Robert Laughlin in discussion at the meeting on 'Physics of the 2D electron gas', 5-10 June 1995.



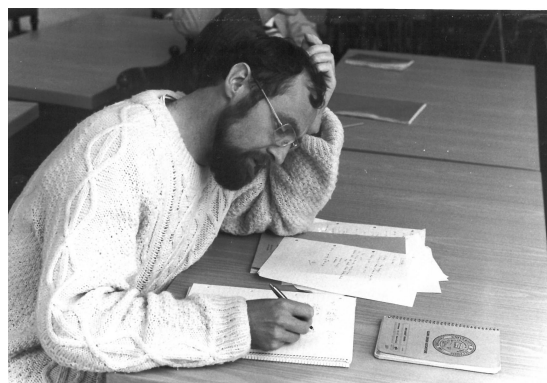
Bengt Gustafsson explaining a point.



Ove Havnes lecturing.



Gerry Brown and Per Lilje.



Chris Pethick preparing a lecture.

The astrophysics summer school at Överboda Kursgård, Skutskär, 1982.



Ole Ulfbeck and three Nordita directors, Aage Bohr, Petter Minnhagen and Allan Mackintosh.

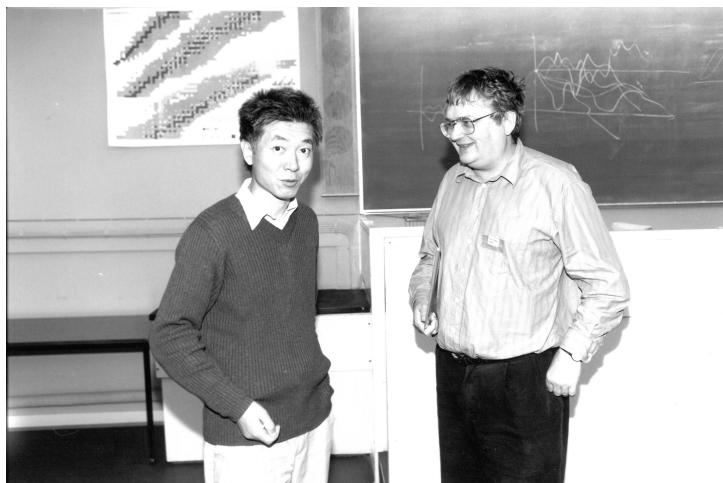


Bob Laughlin.



A lecture in Aud. U.

From the workshop on 'Fundamental Effects in Semiconductors', 1986.



Yi-Cheng Zhang and Per Bak.



Per Bak and Andreas Wirzba
with Chris Pethick and Hans
Hansson behind.



Igor Dzyaloshinskii and Olga
Yartseva (wife of Sergei
Nechaev).

Meeting on 'Self-organized Criticality', 1990.



Bernard Jones, Per Lilje and others in the NBI canteen.



Igor Novikov and others in Aud. A.

From the workshop “Hot Spots in Astrophysics”, July 1990.



Åsa and Nils Robert Nilsson with Aage Bohr.



Hans Wilhelmsson, one of the first Nordita fellows, with Åsa and Nils Robert Nilsson. Lars Brink is behind.



Paolo Di Vecchia, Peter and Johan Bijnens, and Igor Pesando.

Nils Robert Nilsson's retirement celebration, 1993.



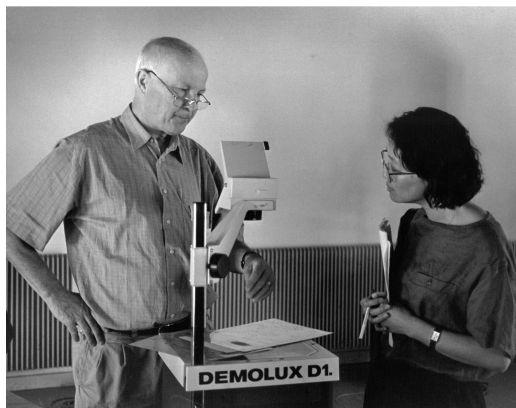
The Krogerup High School grounds.

John Kessler and Mogens Høgh Jensen.

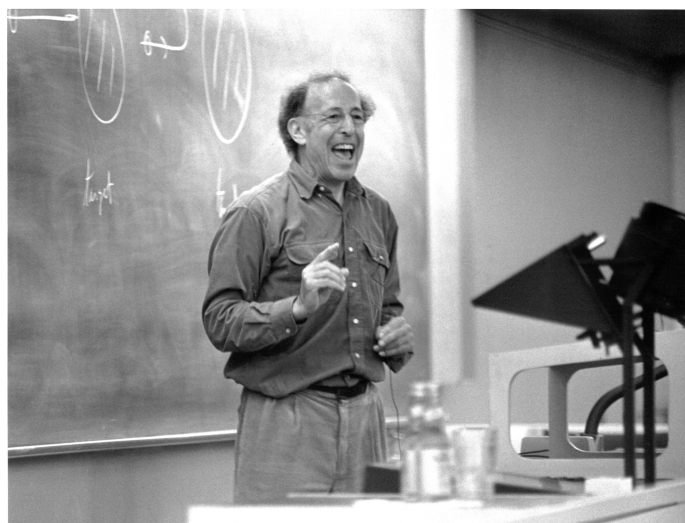


Ole Mouritsen and a participant.

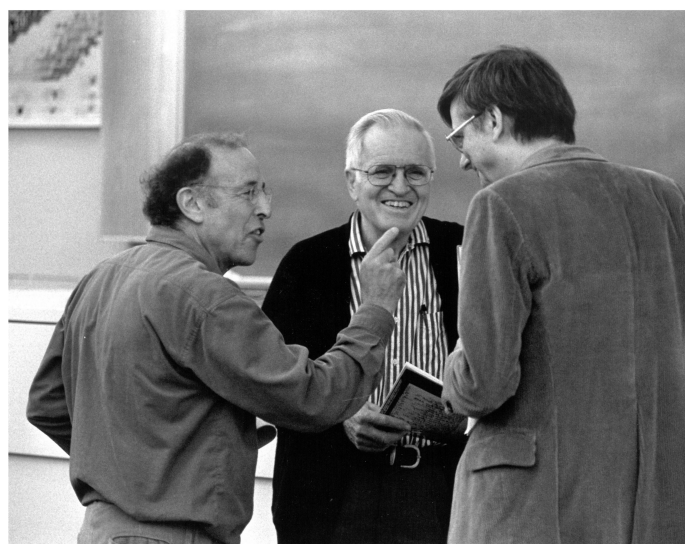
Erich Sackmann and a participant.



Krogerup summer school on 'Physics of Biological Systems', 1995.



Ben lecturing on 'A report on 45 years in the struggle to understand what is going on inside atomic nuclei'.



Ben, Aage Bohr and Alan Luther.



The scene in Aud. U, Paul Hoyer presiding.

Ben Mottelson's retirement celebration, 9 October 1995.



Risto Nieminen and Paul Hoyer.



Paolo Di Vecchia and Jakob Yngvason.



Henrik Smith and Paul Hoyer

More pictures from Ben Mottelson's retirement celebration, 9 October 1995.

Chapter 4

The Changing Face of Nordita

This chapter contains an overview of the scientific activity at Nordita. The account of the first 40 years is taken from ‘Nordita 1957-1997’, the Nordita Annual Report for 1996. The text is the original one, and it has not been edited to take into account what has happened since 1996. This is followed by an epilogue covering the final decade in Copenhagen.

The first 40 years

Ben Mottelson and Chris Pethick

At a round birthday it is natural to look back and survey what has happened over the years. Our aim here is to give a number of examples that illustrate how Nordita has responded to the changing challenges in theoretical physics, as well as the changing needs within the Nordic countries. We shall not attempt to give a detailed historical account of Nordita, and will place most emphasis on what has happened over the second half of the institute’s life. For the early history of Nordita we refer to the report ‘Nordita 1957-82’ issued on the occasion of Nordita’s 25th anniversary, as well as the personal accounts by Torsten Gustafson¹ and Pekka Jauho.² The background for the foundation of Nordita was the long traditions for collaboration between

¹T. Gustafson, ‘Om Norditas tillblivelse’. Lecture presented at the 25th anniversary of Nordita. October 1, 1982. NORDITA-86/24.

²P. A. O. Jauho, ‘Raison d’être of Nordic co-operation in theoretical physics: A personal view.’ Lecture presented at the 30th anniversary of Nordita on October 1, 1987. NORDITA-87/62.

Nordic physicists that stretch back to the middle of the last [nineteenth] century. These were further strengthened by the key role that Niels Bohr and his institute played in the creation of modern physics during the 1920's and 1930's. The idea of establishing a Nordic institute for theoretical physics arose in the years immediately following the Second World War, and after lengthy deliberations at various levels, the establishment of Nordita was authorized at a meeting of the Nordic Council in Helsinki on 21st February 1957. On 1st October 1957 the institute started operations, with Christian Møller as director, and Ben Mottelson, Gunnar Källén, and Léon Rosenfeld as professors. Källén resigned to take up a chair at the University of Lund in 1958, and later Jim Hamilton and Gerry Brown became professors at Nordita. For the first decade of its existence, Nordita's activity was primarily in nuclear and particle physics, the areas in which staff members were then working.

During the 1960's condensed matter physics in the Nordic countries was growing, and it was recognized that the scientific environment at Nordita and its relevance to developments in the Nordic countries would be strengthened in an important way if a significant activity in this area could be developed. An initial step was the appointment of a number of prominent condensed matter physicists, among them Gordon Baym, Vic Emery, Stig Lundqvist, David Pines, and Alf Sjölander as visiting professors. An especially important role was played by John Wilkins, who was a visiting professor for a total of more than three years (including the academic years 1975-77 and 1979-1980). He built up a very active group and trained a number of Nordita fellows. The first permanent appointment was that of Chris Pethick (1975), who at the time was working on quantum liquids as well as on topics in astrophysics. Subsequently Alan Luther, whose research at the time focussed on low-dimensional systems, was appointed in 1976, and John Hertz, whose research was on spin glasses and later on neural networks, in 1980. The latter position represented an expansion of the Nordita staff which had been argued for by pointing to the desirability of increasing the breadth of the scientific environment in the condensed matter field. In making these appointments the Board laid special emphasis on the role of Nordita in developing an activity in frontier areas of physics which were otherwise less strongly represented in the Nordic area. It is significant that many of the Nordita fellows from the early years of Nordita's expansion into condensed matter physics, among them Risto Nieminen, Matti Manninen, Petter Minnhagen, Martti Salomaa, and Jussi Timonen are now (1997) professors in condensed matter physics at Nordic universities.

In the development of the condensed matter activity, an important role was played by the special connection with the Landau Institute that Nordita

was able to establish, building on the strong traditions of the Niels Bohr Institute for collaboration with physicists in the Soviet Union. During the difficult period of the 1980's Copenhagen was an almost unique centre where scientists from both East and West could meet and collaborate on scientific matters.

Another notable feature of Nordita's activity in condensed matter physics was a strong collaboration with the Low Temperature Laboratory of the Helsinki University of Technology, where forefront experiments on the properties of the superfluid phases of liquid ^3He were being carried out. Nordita supported visiting scientists in Helsinki to strengthen the theoretical environment, and scientists and fellows at Nordita were engaged in theoretical analysis of data from Helsinki.

Over the years Nordita has been a centre for studies of aspects of condensed matter outside the main focus of the permanent staff. Among these we may mention the work on electronic properties of metals which was a major activity at the institute while John Wilkins was visiting professor. This tradition was continued by Jens Nørskov, who was assistant professor at Nordita in 1982-1985. He was subsequently appointed as adjunct professor at Nordita and spent much of his time at the institute while employed by Haldor Topsøe, a major producer of industrial catalysts. He later became professor at the Danish Technical University. Also during the years 1986-1988 when Allan Mackintosh was director, Nordita had a significant group working on electronic properties of metals. More recently the study of electronic phenomena in small systems, an area of growing importance for physics reasons as well as because of applications to devices, was a major thrust of Nordita's activity, during and following the period 1992-1993 when Antti-Pekka Jauho was a Nordic assistant professor.

Another area in which the activity at Nordita has been expanding in response to new opportunities in contemporary physics is the study of complex systems. The discovery of universalities that link such diverse systems as planetary and galactic orbits, populations of predators and prey, turbulent flows, and the avoided crossings of the levels of the hydrogen atom in a magnetic field created a new field within statistical physics in which Nordita together with the Niels Bohr Institute has been able to create what is one of the leading centers for such studies. This was possible due to the fortunate confluence of a number of different personalities. At the time of his appointment, John Hertz was carrying out research on spin glasses. The activity in dynamical systems was initiated in 1981 by Predrag Cvitanović, who at that time was assistant professor in particle physics (1980-1984). At about the same time at the H.C. Ørsted Institute of the University of Copenhagen, Per Bak, a former Nordita fellow, Tomas Bohr, and Mogens Høgh Jensen,

who were then graduate students, had independently taken up the study of complex systems. These people formed the core around which the activity in complex systems in Copenhagen grew. After postdoctoral work in the United States, Mogens Høgh Jensen was appointed assistant professor at Nordita (1986-1992), and he, like Predrag Cvitanović and Per Bak, has now gone on to a permanent position in the Danish system.

The study of complex systems has been one of the major themes at Nordita over the past 15 years, and Nordita has played an important role in developing expertise in this area within the Nordic countries by training fellows, and arranging numerous summer schools, workshops and conferences on the subject. Examples within recent years are the summer school on 'Complex systems: Turbulence, Chaos, and Neural Networks' in 1993 and the 'Nordic Non-linear Days' in 1996. The fact that many prominent workers in the field, including Mitchell Feigenbaum, Leo Kadanoff, and Itamar Procaccia (who is an adjunct professor at Nordita), frequently visit contributes to the excellent environment at Nordita for this work. Over time many different aspects have been taken up, including quantum chaos, turbulence, growth phenomena, neural networks, and more recently, biological problems, a topic on which the current Nordic assistant professor in the area, Kim Sneppen, works. Another aspect of the work on complex systems is that it has been a source of inspiration also to scientists working in other areas of physics, including condensed matter physics, nuclear physics and astrophysics. Considering how young the field is, it is noteworthy that a number of former Nordita fellows, including Per Dahlqvist, Kristian Lindgren and Mats Nordahl already have permanent positions at Nordic universities.

Another major development over the past two decades has been Nordita's expansion into the area of theoretical astrophysics, which played a significant role in the development of this field in the Nordic area. The revolutionary observational discoveries concerning the basic cosmological issues and phenomena involving high energies pose profound questions that theorists have to struggle with. The germ for growth of astrophysics at Nordita can be traced back to Bengt Strömgren's becoming affiliated with Nordita on his return to Denmark in 1967. The following year Bengt Gustafsson came as a Nordita fellow to work with Bengt Strömgren. Subsequently series of seminars on astrophysical topics were held at the Niels Bohr Institute and Nordita, and a number of astrophysicists and physicists with interests in astrophysical phenomena, including Charles Barnes, Jesse Greenstein, Thomas Gold and Vittorio Canuto were visiting professors at Nordita. In 1975 Chris Pethick was appointed as professor and in that fall he and Bengt Strömgren arranged an intensive two-week school, the Astrophysics Novemberfest, on a range of topics in theoretical astrophysics. This attracted 50 students from

the Nordic Countries, among them Claes Fransson, Einar Gudmundsson, and Roland Svensson, all of whom are now full professors in astrophysics but who at that time had yet to begin their graduate studies.

In 1976 Richard Epstein was appointed as assistant professor in astrophysics, greatly strengthening the breadth of activity at Nordita. In addition during this period Gerry Brown, and Hans Bethe, who was a regular visitor, were engaged in an active collaboration on supernova explosions. Nordita became one of the few centers in the Nordic communities for work on some of the modern themes in contemporary astrophysics, especially what is generally termed ‘relativistic astrophysics’, and fostered the development of young Nordic scientists working in this area. The more recent assistant professors in astrophysics each brought with them expertise in some new facet of astrophysics: Bernard Jones (1983-1989) working on galaxy formation and cosmology, Roland Svensson (1985-1990) on active galactic nuclei and processes in relativistic plasmas, Marek Abramowicz (1991-1993) on general relativity and accretion discs, and the current one, Sasha Kashlinsky (1994-1997) on microwave background fluctuations and cosmology. Following the retirement of Gerry Brown, Bernard Pagel was appointed as the first professor of astrophysics at Nordita in 1990. His broad interests spanning a wide range of topics in both theoretical and observational astronomy, especially centering on issues of nuclear abundances and their interpretation in terms of galactic and cosmological history, greatly expanded the interface between Nordita and the astronomical community.



Bernard Pagel has a question. Birgitta Nordström is on the right of him.

The impact of Nordita's efforts in astrophysics may be judged from the fact that many people appointed in recent years to permanent positions in the field at Nordic universities were Nordita fellows or had been closely associated with Nordita. These include Claes-Ingvar Björnsson, Jørgen Christensen-Dalsgaard, Claes Fransson, Einar Gudmundsson, Bengt Gustafsson, Per Lilje, Jes Madsen, Åke Nordlund, Roland Svensson, and Esko Valtaoja.

The 'classical' fields at Nordita (nuclear and particle physics) have also changed profoundly in response to the evolving scientific challenges. The boundaries between the two areas are not well defined and are constantly changing. Thus many topics which fell within the domain of particle physics two decades ago are today regarded as being part of nuclear physics. The overwhelming success of the Standard Model of the weak, electromagnetic and strong interactions has attracted a large part of the particle physics community to the issues involved in formulating a theory that can provide a consistent unification of all known interactions including gravity. This has required the introduction of new symmetries such as, for instance, supersymmetry, which is a symmetry between fermions and bosons, and the extension of field theories based on point-like objects to string theories based on one-dimensional extended objects (strings). Since strings theories provide a quantum mechanically consistent extension of Einstein's theory of general relativity unified with the gauge theories that are the basis of the Standard Model, they have been proposed as unified theories of all interactions at vastly greater energies than those presently available. Thus the presence at Nordita of Paolo Di Vecchia, who does research in these areas, represented an important new chapter in the particle physics activity at the institute. He was first an assistant professor at Nordita (1974-1978) and was later appointed as Jim Hamilton's successor as professor (1986). The activity in particle physics has also broadened to encompass cosmic phenomena, the area now generally referred to as astroparticle physics, and Kari Enqvist, who works in this area, was an assistant professor during the period 1990-1994.

The nuclear physics activity, besides maintaining a strong interest in the current issues of nuclear structure (effects of large angular momentum and extreme isospin), has actively cultivated the connections to other fields: astrophysics (Pethick, Brown), atomic clusters (Mottelson), non-linear systems, and especially particle physics. At the latter interface one may mention the work on models of nucleons and nuclear forces of Brown and Andreas Wirzba (assistant professor, 1986-1992), on the use of chiral perturbation theory to understand particle interactions by Johan Bijnens (assistant professor, 1992-1997), on properties of mesons in nuclei and sub-nuclear degrees

of freedom by Wolfram Weise (adjunct professor 1992-present) and relativistic heavy-ion interactions by Henning Heiselberg (Nordic assistant professor, 1995-present). Another significant area is the study of Quantum Chromodynamics, where Paul Hoyer (Senior fellow, 1977-1981, director, 1994-present) and Vladimir Braun (assistant professor, 1995-present) have active research programmes. In providing this breadth of scientific environment Nordita has relied heavily on the possibility of appointing assistant professors, as is clear from the names of the leaders in the interdisciplinary connections sketched above.

As in other areas of physics, many Nordita fellows in particle physics, among them Hans Hansson, Paul Hoyer, Jon Magne Leinaas, Carsten Lütken, Per Osland, Finn Ravndal and Bo-Sture Skagerstam, have become professors at Nordic universities. In nuclear physics there are likewise many faculty at Nordic universities who are closely associated with Nordita. These include Ikuko Hamamoto, Eivind Osnes, Dan-Olof Riska, Jan Vaagen and Sven Åberg.

The form of Nordita's activities and its administrative structures have undergone major developments reflecting the changing structure and needs of the Nordic scientific community. The contact with this community was greatly strengthened by the appointment of Nils Robert Nilsson (coming from Uppsala) as the chief of administration in 1972. Nils Robert Nilsson's enthusiasm, his creativity in assisting physicists in realizing their projects, and his broad network of connections in the Nordic countries and elsewhere were of immense importance to Nordita and the Nordic collaboration more generally for more than two decades.

Similarly it was of great value to Nordita that Paul Hoyer (Helsinki) was able to accept appointment to the directorship (1994), thus for the first time bringing a scientist from outside the Copenhagen area to this position.

Another initiative to strengthen contact between the Nordic scientific community and Nordita was the setting up of sub-field committees in the various areas of physics. At the suggestion of John Wilkins, this was initiated in 1975 in condensed matter physics, an area of physics in which the contact within the Nordic countries were less well developed than in nuclear and particle physics, in which there already existed strong Nordic links stemming from the central role that the institute in Copenhagen had played in the scientific life in these areas. Subsequently sub-field committees were also established in other areas of physics, and these have played important roles as a channel for communication between Nordita and the Nordic community, and as part of Nordita's decision-making process.

Nordita has in the second half of its 40 years initiated activities that aim at making contact with younger scientists at an earlier stage in their career

than represented by the usual fellowship program. These new activities have taken the form of summer schools focused on current research in the different subfields of physics, and contact weekends to which PhD students from the Nordic area are invited to Nordita in order to hear lectures from the staff and get to know each other. Typically in any year Nordita is strongly involved in the organizing of about two summer schools, and in 1996 there were ones on magnetic fields in astrophysics, on high-energy physics phenomenology, and on non-linear phenomena in physics and biology. In 1997, new initiatives include a master class aimed to introduce undergraduates to exciting current topics, and a two-week cross-disciplinary programme to bring forefront areas of research to the attention of beginning graduate students.

An important step to increase Nordita's scientific breadth and to strengthen ties to the international scientific community has been the appointment of prominent scientists as adjunct professors. These come from a number of different countries, and are broadly distributed in terms of fields of interest.

In the structure of activities at Nordita another innovation has been the attempt to have focussed programs addressing current problems in some well defined area for a period typically of order a few months, inspired to some extent by the programs at the Institute for Theoretical Physics at Santa Barbara. Among programs arranged by Nordita were the ones on 'Nuclear Structure in the Era of New Spectroscopy', 1989, to explore perspectives opened up by the new generation of nuclear detectors, 'Hot Spots in Astrophysics', a three-week workshop in 1990 on frontier problems in relativistic astrophysics organized by Igor Novikov, and that on 'Perturbative QCD' held in Lund in 1991. The latter brought together experts on analytical solutions with the outstanding group in Lund working more phenomenologically. Also in 1991 there was a program on 'Physics of Quantum Chaos and Measurement' that brought together the leading workers in the subjects. A more extended programme on the physics of nuclei that can be investigated using facilities with beams of radioactive nuclei took place in 1993-1995. This programme was proposed by physicists at Nordic universities (T. Engeland, J. Vaagen and S. Åberg), and was run by them in collaboration with members of the staff at Nordita.

This mode has now evolved into what are termed 'Nordic Projects', of which there are at present time ones on accretion disks in astrophysics, relativistic heavy-ion collisions, supersymmetric theories, computational materials and surface physics, fundamental constituents of matter, and the nature of cosmic γ -ray bursts.

Nordita has made considerable efforts to find additional financial support from a variety of funding agencies. Among these are the research councils in the Nordic countries, which support graduate students at the institute for

periods from months up to about a year, the EU, which supports postdoctoral positions and networks, NorFA, which supports summer schools, and workshops, and the special funds from the Nordic Council of Ministers for the Baltic Countries and NW Russia, which provide fellowships for young scientists. The total support from these sources is in the region of 10% of the total budget and it adds significantly to the activities of the institute. It is also important to bear in mind that Nordita receives a considerable amount of indirect support because, by virtue of its attractiveness as a scientific center, many visitors come supported by funds from their home institutions.

The political developments in the Baltic countries have opened the possibility for Nordita to greatly strengthen its interaction with physicists in this area and participate in the renaissance of scientific life that is being experienced there. Initially this took the form of visits of senior Baltic scientists to Nordita, and visits by Nordita staff and other Nordic physicists to centres in the Baltic countries. More recently, Nordic summer schools have been held with participation by both Baltic and Nordic students and two of these schools have taken place in the Baltic countries. A further step has been the establishing of a fellowship programme for promising young scientists to work at Nordita, and a number of the fellows have begun collaborations with Nordita staff.

The Fifth Decade

**Axel Brandenburg, Paolo Di Vecchia, John Hertz, Alan Luther,
Ben Mottelson, and Chris Pethick**

With the retirement of Nils Robert Nilsson, Nordita's head of administration, resources became available to appoint a full-time director, and Paul Hoyer from the University of Helsinki took up the position at the end of 1995. This implemented one of the recommendations of the international evaluation of Nordita in 1988. During Paul's tenure, a number of new initiatives were instituted. One was the Master Class for undergraduate students, at which leading international figures were the lecturers. This has continued to this day. Other programmes include Nordic Corresponding Fellows and Nordic Projects.

During this decade, the research areas at Nordita continued to develop, in many cases cantilevering out from other areas of physics studied at Nordita. Astroparticle physics, at the interface between particle physics and cosmology, became an important activity, with assistant professors Kari Rummukainen, Kimmo Kainulainen, Steen Hannestad and Anupam Mazumdar.

Growing out of the interest in complex systems, biological physics became an important area of study, with the appointments of Kim Sneppen and Ralf Metzler as assistant professors. A group working on theoretical neuroscience was built up by John Hertz, developing analytic and computational methods for studying the dynamics of networks in the neocortex.

In nuclear physics, Nordita was a significant node in the network of scientists studying neutron-rich nuclei, and especially of nuclei with neutron haloes. The study of the physics of QCD became an important activity when Dmitri Diakonov was professor during the period 1997-2005. His work with V. Petrov on possible pentaquark states led to a flurry of activity, both theoretical and experimental.

In particle physics string dualities, D-branes and the Maldacena conjecture were studied and attempts were made to use the last two developments for non-conformal gauge theories such as QCD. Summer schools on these subjects for Nordic PhD students were arranged in 1998 and 2003.

The appointment of Axel Brandenburg to succeed Bernard Pagel as professor resulted in a strong activity in the study of magnetic fields in astrophysics. In addition, Axel, in collaboration with other scientists in the Nordic countries created a Nordita Network in astrobiology, the study of the history (and future) of life in the Cosmos.



Eivind Osnes and Dmitri Diakonov at Nordita's 40th anniversary, 1997

The experimental realization of Bose–Einstein condensation in dilute atomic vapors in 1995 led to an explosion of creativity and of fruitful collaborations between physicists in condensed matter physics, atomic physics and nuclear physics. In Copenhagen, an active group in this area grew around Henrik Smith and Chris Pethick.

The methodology of theoretical physics has broad applicability to societal problems and not only to pure science. This was brought out in two meetings organized by Paul Hoyer. The first was ‘Methods Meet: Physics and Topical Issues of Society’ in 1999 and the second cross-disciplinary event was the ‘Nordita School for Physicists on the Physics of Climate’ in 2001.

Shortly after the appointment of Petter Minnhagen from the University of Umeå as Nordita's director in 2002, planning for the future of Nordita became a major preoccupation. On 29 October 2003, the Nordic Council of Ministers (MR-U) decided to transfer Nordic research institutes to national bodies and reduce funding. In the spring of 2004 two offers for the future hosting of Nordita were made, one from the University of Copenhagen and the other from Stockholm (the Royal Institute of Technology and Stockholm University). Later Uppsala University joined the latter consortium. During the autumn of 2004 an evaluation of Nordita and the possibilities for future funding was performed by an international committee. After a series of

meetings and consultations, NMR decided to move Nordita to Stockholm. During the final period in Copenhagen, Paul Hoyer was again director from 1 September 2005 to 31 July 2006, after which Ulf Wahlgren was director. Operations started in Stockholm on 1 January 2007.

Chapter 5

Personal Memories

Introduction

In order to gain impressions of what Nordita fellows, including senior fellows, experienced in their years time at Nordita, a number of fellows were asked to write short accounts.

111 fellows and Nordic junior staff were invited to contribute and we received 78 replies. The group has been divided into two, according to whether a person's association with Nordita began in 1957-1982 or 1983-2007. I tried to make a random selection, but had to take into account the possibility of contacting the person in question by mail or email. The result was that 50 fellows from the first period were approached and 61 fellows from the second. The difference in numbers is partly due to the fact that several former fellows could not be reached, and partly the decision of the Board in March 1977 to raise the annual number of fellows from an average of 15 per year to 17, as new areas of physics were included. The modest increase was possible as the traditional popular research areas (nuclear physics and high energy physics) were supplemented by the new areas: astrophysics, solid state physics, physics of complex systems, and biophysics.

Non-Nordic members of the junior staff during the period, 17 in all of whom 10 responded, and members of the administrative staff in 2006 were also asked to contribute.

In addition we include contributions from some Nordita professors, as well as some other people having a close association with Nordita, e.g., as a long term visitor.

Most of the contributions were written around 2016.

Helle Küllerich

The First 25 years

Gordon Baym, USA, frequent visitor over many decades

Happy Memories of My Early Days at Nordita

I first came to Niels Bohr's Institute in Copenhagen, from Harvard, as a postdoc in the Fall of 1960 for two years, just a few years after Nordita started operation there. At that time, life at the Institute was fully integrated; independent of people's formal associations be they Nordita or Universitetets Institut for Teoretisk Fysik (now NBI); we were all one happy group scientifically and socially.

My first formal connection with Nordita was in the Spring of 1970 when I came from Urbana to be a Nordita Visiting Professor for some eight months. This time was one of the most productive in my life. Pulsars were discovered only recently before, and it was great fortune to work there with a remarkable group of people, including Hans Bethe, Chris Pethick, David Pines, Phil Siemens, John Negele, and Vijay Pandharipande, who were all interested in understanding the neutron stars that lay at the heart of pulsars. At this time, Chris, Hans and I wrote our fundamental paper setting out a consistent theory of the nuclear physics of the crust and the liquid nuclear matter core.

How Chris and I came to work with Hans is an amusing story in itself. The mailboxes in Ekspeditionen at the Institute were labelled only by the first letter of people's last names, and so one day after lunch when I was rummaging through the B-box looking for my mail I happened to notice a postcard addressed to Hans Bethe from the journal *Astronomy and Astrophysics*. Naturally I turned it over and read it, and learned that he had just written a paper with Gerhard Börner and Katsuhiko Sato on the nuclear physics of neutron stars. But the presence of the postcard also meant more importantly that Hans would be coming to Copenhagen. Chris and I were immediately able to get a preprint of their paper, and set out to make minor improvements on the condensed matter physics it relied on, so much so that their calculation became completely inconsistent. Chris and I had been worrying earlier, with David Pines, about solid state effects in the interiors of neutron stars, including superconductivity, superfluidity, and electrical conductivity, and were totally unexperienced in nuclear physics at this time. But when Hans arrived and we told him about our 'improvements' of his

paper, he announced that we must solve the problem, and the three of us set about immediately to develop the nuclear theory consistently. What a wonderful experience it was for us to be able to learn nuclear physics from the grandmaster himself – something that was completely unlikely to have happened had not both Hans’s and my last names started with the same letter!

Working with Hans was a great challenge. Chris and I started out to calculate on a Marchant mechanical calculator, but Hans was far faster at calculating with his slide rule (limited, we speculated, only by the Lorentz contraction of the slider). The only way we could keep up was to learn to program the GIER computer in the basement of Nordita, an early generation Danish transistorized machine. Its language was ALGOL, which being akin to the Whitehead-Russell symbolic logic program, was easy to master. The GIER machine with a grand total of some five thousand (42 bit) words of memory seemed dazzling fast at the time, although in integrating the Tolman-Oppenheimer-Volkov equation for the structure of neutron stars we could hear it physically clunking through each iteration. The interface with the machine was by punched paper tape, which was quite a nuisance, since the tapes would occasionally rip. But it had the world’s fastest paper tape reader, and in only a few seconds it would dump a huge rolled tape as it was read into a big garbage can, and we would have to roll it up again carefully.

We were sufficiently successful at calculating neutron stars that Hans soon left the calculations to us. Hans’s approach to problems was always to ask, what is a first simple calculation, and then to understand what the differences were between this calculation and the numerical results; from this we developed what we called ‘the method of the imaginary Hans Bethe’, to ask the same first questions and carry out the needed improvements of the calculations. One day, he showed up with a very lengthy derivation of a result (on pages numbered something like 2050 to 2094, as was his wont), but did not understand why his calculation gave an unexpected answer he didn’t like. Chris and I immediately pointed out to him that he was working with the Helmholtz free energy, rather than the enthalpy, and that the correct result could be derived in a few steps. “Ach,” Hans responded, “I am in a den of thermodynamicists!”.

In our final paper we had wonderful input from Phil Siemens and John Negele, Hans’s recent students who were postdocs in Copenhagen that Spring, as well as Vijay Pandharipande, whom Hans had met in India and also brought to Copenhagen. I was delighted that the University of Illinois could offer Vijay a faculty position just a few years afterwards, and he was my close colleague until his untimely death in 2007.

That Spring I gave a series of lectures on the nuclear physics of neutron

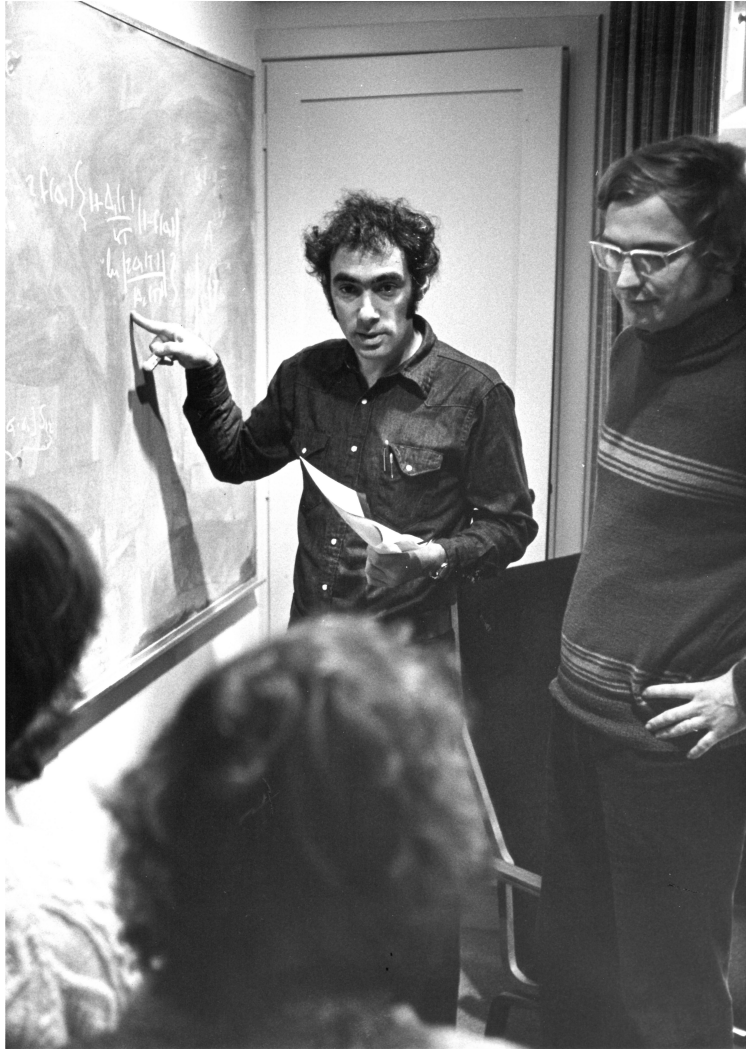
stars, which became a little Nordita book, ‘Neutron Stars’. Aage Bohr and Ben Mottelson became interested in our work, and were tremendously encouraging. Some time after returning to Urbana, Gerry Brown (on whom I dwell more below) called me up to ask if I would be interested in becoming a full time Nordita Professor. This offer was very very tempting, but unfortunately, for family reasons, I had to decline it, and remained in Urbana, but came to Copenhagen at every opportunity.

I returned in 1976 for essentially a year’s visit, again as a Nordita Visiting Professor. This time I gave a series of lectures on ‘Neutron Stars and the Properties of Matter at High Density’, made into another Nordita book. A lovely photograph of this time became the cover of the report ‘Nordita 1957-82’, showing everyone enthusiastically listening to a lecture by Alexander Polyakov, who was also visiting then. I kept returning to Nordita for visits over the years, occupying Christian Møller’s office after he retired. One of the unusual features of that office was his reprint collection, carefully filed in a set of boxes labelled A-Bal, Bal-Byz, etc., including a box labelled Sex (which closer inspection revealed that the first reprints it contained were by the Austrian relativist, Roman Sexl). A later task of mine at Nordita in Copenhagen was to be on the committee to chose Ben Mottelson’s successor at the time of his retirement, an operation that unfortunately failed to produce a successor acceptable to all.

The people of Nordita were one of its delights. In the early days Edith Abrahamsen sat in the smoke filled corner office, together with lovely young Helle Kiilerich, always friendly and helpful. Helle gave me my own J key, a version of which I cherish to this day. Later Ellen Pedersen, Hanne Bergen, Vivi Bech, and Anna Maria Rey joined the staff. Once when Chris and I got into a rather loud argument, Alf Sjölander, then a Nordita Visiting Professor, went to the corner office to gently register his feelings about our rude deportment, remarking to the effect that “Professors do not talk to each other like that!”

Gerry Brown was one the most important persons in my life at Nordita, a close scientific collaborator and friend. He mentored me when I was first in Copenhagen, encouraging me to apply the work that Leo Kadanoff and I were doing on conserving approximations to the question of spurious states in nuclei. Gerry and I would spend occasional weekends together relaxing and discussing physics at his ödegaard in southern Sweden, where he loved cooking, farming potatoes, and taking walks. On one of these walks, by a lake, we conceived our paper on the Ericson-Ericson Lorentz-Lorenz effect. Gerry’s interest in astrophysics, which was a major scientific driver in his later years, grew in part out of our many walks and talks together.

Gerry loved to have parties. In addition to his annual pajama parties,



A blackboard discussion, with Gordon Baym (left) and Martti Salomaa around 1977.

one that particularly stands out was the get-together he and Norton Hintz arranged in the early sixties at the Langelinie Pavillion for the Institute and the Bolshoi Ballet – which was in town. Dancing with the great ballerina Maya Plisetskaya was the absolute highlight of the evening.

Nordita in Copenhagen was indeed an irreplaceable fusion of forefront science with a stimulating and nurturing life. I cherish my time as part of it.

Hanne Bergen, secretary, 1976-2006

Thirty Years as a Secretary at Nordita

My wish to use the English language was the reason for applying for and getting the position at Nordita. After finishing my professional training I attended a language school in England. After that I was employed as secretary in various companies, including an advertising agency. At Nordita I worked as secretary to Chris Pethick and the newly established astrophysics group. Over the years I worked for several senior researchers in the astrophysics group, including Bernard J. T. Jones, Roland Svensson, Marek Abramowicz, Axel Brandenburg, Sasha Kashlinsky, Dmitri Diakonov, Rachid Ouyed and many others, all of different nationality and personality. It was never boring!

One of the tasks that went with the job was the preparation of conferences, meetings and workshops. During my years at Nordita I was secretary for about 40 meetings and conferences. With each meeting my understanding of what was good and what could be improved grew and at the end I was practically an expert with a recipe or script for meetings to go by. Often some of the participants were reappearances, since the hot names within a particular field were often hot enough for a couple of meetings in the following years.

Many researchers both in and outside the Nordic countries worked together with Nordita's researchers and came on shorter or longer visits. Several former fellows became members of Nordita's scientific committees and later of the Nordita Board and it was always a pleasure to meet again. In connection with the meetings of the Board a dinner was arranged for all Nordita staff and it was always an enjoyable occasion. There was also a long tradition for regular summer guests from universities round the world, so the summer periods were far from dull. The typing of manuscripts, reports, letters of recommendation, etc. took up a large part of a secretary's tasks. The originals were handwritten and sometimes hard to read, which caused some amusing misunderstandings. The introduction of IT greatly reduced the task of typing; among other things it became easier to write formulae. It also made it possible to create home pages and agendas in connection with meetings, making it easier for both participants and administrators to keep track. Email also meant a relief from some of the work, but also made it possible for researchers to send tasks to the secretaries whether they were at home or abroad.

In the 1990s Nordita received an appropriation from the Nordic Board of Ministers in order to establish cooperation with the Baltic countries in the

form of three to six month fellowships at Nordita. Bernard Pagel was the prime mover in this project and I took care of the administrative side, which included advertisements, visa, housing and a general welcome to Nordita. The Baltic fellows brought back a miscellany of things, including computer equipment, which was difficult to get at home. I found Nordita to be marked by cooperation and a generally positive atmosphere. In the daily life Nordita functioned almost as a family. I must not forget the administrative coffee break, where researchers who had the time and inclination took part. We had pleasant talks about everything but physics. We helped the researchers in their daily life in Denmark, sometimes looked after their children and often helped with housing, although the wish of one American junior visitor-to-be in 1976 was beyond us: A house north of Copenhagen with a view over the sea and close to the Institute at a reasonable price.

Jakob Bondorf, Denmark, 1963-65

Many Frontiers in Physics

I studied physics at The Institute for Theoretical Physics from 1958 to 1962. Coming with a degree in civil engineering from the Technical University, I had found my scientific world far too narrow by working only with Newton's second law applied to things at rest. I desired to change to physics in general. Of course the studies should be made at Blegdamsvej. After an application and conversations with, among others, Aage Bohr, I was accepted for graduate studies in physics at Copenhagen University. I soon felt part of the large and mixed crowd of people working at the Institute. The crowd contained students, professors, visiting scientists from all over the world, technical and other staff, young and old. In the 'crowd' there were also other institutions such as Nordita. And out in the world there were many people in direct and constant contact with the crowd at the Institute.

What subject and whom to choose as an adviser? I went to several study groups and courses, both specialized and more general ones. In the second year of my studies I followed Ben Mottelson's lectures on nuclear physics beginning in September 1959. Making notes in Danish from an English speaker was impossible, so here I made my first direct notes in English. These notes are a gem for me. Ben was fantastically inspiring. His lecture series led me to choose nuclear physics as the main subject for my thesis. But whom should I choose as adviser? I sought advice among the other students, some of whom had eased my way to Blegdamsvej. In particular there were two girls, mathematics students, with whom I spent a lot of time. They were Ragnhild (Ra) and her friend Anna Marie (Ann Maj). Ra later became my wife and Anna Marie became Aage Winther's wife. I asked them whom I should ask to become my adviser. And Anna Marie was sure. My adviser should be Ben Mottelson. Why? "Because he is so nice", Ann Maj answered.

Soon afterwards, I went to talk with Ben, who had his office near the library. I was a bit nervous because Ben was not employed by Copenhagen University but by Nordita. He received me kindly. I told him my dilemma: I would very much like to do something at the frontiers of physics, but some students said that particle physics was the frontier. Ben answered with his loud laugh which could be heard in the whole building all the way to the ground floor and said: "There are so many frontiers in physics". That was a decisive point. He became my adviser not only for my master thesis but also

when I was a Nordita fellow 1963-1965. He suggested that I look at nuclear collision processes, which form the links between nuclear experiments and nuclear structure. Most of what I have done since then in physics relates to some aspect of colliding nuclei. It led me to collaborations with groups in many countries. Among them also several experimental groups.

Iver Brevik, Norway, 1966-1968

Some Reminiscences about Nordita in the Period 1966-68

I remember well my first day at Nordita. Actually I had never visited Denmark before. A few years earlier I had completed my education as a technical physicist at the Norwegian Institute of Technology (NTH) in Trondheim, and had in the time thereafter been a scientific assistant at the same institution's Institute of theoretical physics. I then got the opportunity to spend a period as a fellow at Nordita and looked forward to it, especially with the hope of getting some contact with Professor Christian Møller, at that time the Director of the institution. Møller's book on relativity had already then been of great value to me in connection with my initial studies on electromagnetic theory in media.

So, one Monday morning in the early autumn of 1966 I found myself standing in the Nordita headquarters, wished warmly welcome by the young Helle Kiilerich and her head Edith Abrahamsen. While speaking together on practical matters, Edith however suddenly made a digression and exclaimed: "I do not understand - why has Dirac not turned up yet?" He was scheduled for a seminar at the institute the same day. It struck me almost like a shock: Dirac! As all other theoretical physicists, I knew that he was regarded as one of the luminaries of theoretical physics in the century, and I think I had read his book on quantum mechanics at that time, but I had no idea whether he was still alive. I felt it almost as if Albert Einstein should be expected to come in through the doors!

Then, at 4.15 pm the same Monday I benched in a crowded Auditorium A at the Niels Bohr Institute, waiting for Dirac's seminar. And the one who presented the speaker to the audience turned out to be just Professor Møller, the man whom I had primarily come here to meet. I had never seen him before. He used some time to tell some memories from the earlier days in the thirties, at the Niels Bohr Institute. Dirac had, as one would expect, a special reputation already then. He would often sit quite alone in the innermost room in the library, and could sometimes write a complete research paper in one day. As Møller said, his colleagues were almost frightened by him!

Although I did not take notes and am not able to reproduce details of Dirac's talk now, I remember the topic very well: it was about quantization of fields in constrained volumes. The talk was followed by some discussion, but there was no heated discussion then. I recall, however, a statement by one brilliant young professor, made after the lecture: "Dirac is completely

outdated! Modern theoretical high-energy physics is about bootstrap methods, not field theory”.

Some years have elapsed since then. What is old-fashioned now is just bootstrap theory, not field theory which is definitely alive. Quantization in restricted volumes found for instance an application a few years later, in connection with the MIT bag model in 1974. One may be left pondering about what is a characteristic property of many of the geniuses: is it not that they may be able to foresee the future, instead of adhering to fashion and chasing the “research frontier”?

So much for Dirac and my remarkable first-day encounter with Nordita. During my two years at the place I got a good scientific contact and even friendship with Christian Møller. Another senior member of the staff whom I remember with gratefulness, is Professor Léon Rosenfeld, a former close collaborator with Niels Bohr himself. During my long struggle with the electromagnetic theory in continuous media it was Rosenfeld who read and commented on my various manuscript versions in detail, before they were published at the Royal Danish Academy of Sciences. Rosenfeld could personally appear rather strict, but once the shell was broken, he was very friendly and helpful. At my doctoral defense at NTH in 1970, it was he who served as the first opponent.

In addition to these senior people, I got good contact also with other fellows of my own age, and we wrote several papers together. Later, I have visited Nordita now and then. My stay there as a visiting scientist in the autumn of 1980 was also a fruitful period. Practical circumstances have however prevented me from being there for longer periods lately.

After my period as a fellow was over in 1968 I went back to my earlier institute at NTH for a few years, and got thereafter a permanent position as a lecturer at the Royal Norwegian Air Force Academy in Trondheim where I stayed for a long period. For the past 25 years I have been a Professor of Mechanics at the Norwegian University of Science and Technology.

In conclusion, I remember Nordita with gratefulness. The institution proved for me to be very valuable and supportive. Also, the living conditions in Copenhagen were very good for my accompanying family, much due to efficient help from the secretaries at the institute.

Christofer Cronström, Finland, 1965-66

A Young Theoretician's Impressions of Nordita in 1965-1966

My wife, son and I arrived in Copenhagen in the very beginning of 1965, where I had obtained a scholarship at Nordita, starting January 1, 1965. I had obtained my MSc degree at the University of Helsinki in 1962, with physics, theoretical physics and mathematics as the main subjects. Theoretical physics was in its infancy in Finland at that time, with a handful of senior theoretical physicists or mathematicians in Finland with interests in questions related to theoretical physics. Many of these senior persons had spent time at Nordita, which from its beginning in 1957 was a very important institution for the development of theoretical physics in Finland.

I finished my masters thesis in 1962 under the supervision of Professor K. V. Laurikainen, who had been appointed professor of nuclear physics in 1960 at the University of Helsinki. My masters thesis dealt with questions related to low energy proton-proton scattering, and after receiving my masters degree, I continued my studies in theoretical nuclear physics for the licentiate-degree at the Department of Nuclear Physics in Helsinki. This department had been established by Laurikainen in the year 1961, and offered also the beginnings of systematic studies in theoretical physics at the University of Helsinki. Besides my continued studies in nuclear and theoretical physics, I also continued studies in mathematics, where my main teacher was Professor Paul Kustaanheimo, who had also been at Nordita in the 1950s. At present he is perhaps best known among theoretical physicists for the so-called Kustaanheimo-Stiefel transformation, which has found applications both in astronomy and in quantum physics. At the Department of Nuclear Physics, Kustaanheimo also gave a course on general relativity in 1964, which was much appreciated by the students and assistants at the Department, including myself.

In the fall of 1964 my licentiate thesis was completed, the results of which were published in 1965 in a joint paper with K. V. Laurikainen, under the title "On One Boson Exchange Potentials in Nucleon-Nucleon Scattering". I had earlier applied for a scholarship at Nordita, and was accepted to begin working at Nordita in January 1965. I had read, or at least glanced through most of the Nordita preprints which I could get hold of in Helsinki in the period 1962-1964, and had also met briefly with Professor Ben Mottelson and Professor Gerald Brown in Helsinki in this period.

It was naturally exciting for my family and myself to come to Copenhagen, where we settled down in a modest sized house with a small garden in Brøndby Strand south of central Copenhagen. During my first day at Nordita I introduced myself at the offices of the Director of Nordita, Professor Christian Møller and the Head of Administration Dr. Stefan Rozental, who both welcomed me in a very kind manner. Soon thereafter Gerry Brown invited my wife and me together with a few other Nordita fellows for dinner. Later on my wife and I participated in dinners for Nordita fellows arranged by e.g. Professor Møller and Professor James Hamilton. This was a nice tradition at Nordita, in contrast to the situation in Helsinki, where for instance professor K. V. Laurikainen did not have such social contacts with his research students.

I also met a few physicists from Finland whom I had only met briefly before, for instance Matts Roos, who had been working abroad for several years after his graduation from the Technical University of Helsinki, which in those days was called the Institute of Technology and nowadays is called the Aalto University. He invited me to collaborate on a project concerning leptonic decays of hadrons, which he was working on together with Niels Brene and Lene Veje at the Institute for Theoretical Physics (UITF) in the same buildings as Nordita at Blegdamsvej. This was a kind invitation, and I did my best in performing my part of the calculations required. The joint work resulted in a paper entitled “Leptonic Decays of Hadrons”, which was published in *Phys. Rev.* in 1966. I was certainly a junior partner in this project, which for my part did not continue after Matts Roos left for CERN soon after the paper was finished. Simultaneously with this work I also completed a second masters thesis in mathematics for Professor Paul Kustaanheimo, which was related to the representation theory for the rotation group in three dimensions, using the special spinor formalism developed by Kustaanheimo. After the submission of this work, I got the Lic. Phil. degree from the University of Helsinki on February 18, 1965.

The everyday life at Nordita was inspiring, with weekly seminars given by well-known visiting physicists or staff members at Nordita or UITF, and with lectures by the Nordita professors. I listened for instance to the lectures by Professor Hamilton on pion-nucleon scattering, which were certainly very good lectures. At these lectures I got acquainted with e.g., Holger Bech Nielsen, who later became well known as a brilliant young theoretician. I also befriended other young Danish physicists, of whom I here mention Benny Lautrup and Poul Olesen, who were working in the main building.

I did not find any senior Nordita professor to work with as a research supervisor. In the absence of Gerry Brown, who had left for America soon after I had arrived in Copenhagen, the natural choice would have been Pro-

fessor Hamilton, but I had the impression that he had his hands full with his collaborators and other students. I may well have been wrong in this respect. Anyway, I returned to questions which had arisen in my licentiate work in theoretical nuclear physics, namely the approximations involved in deriving local Yukawa-type potentials used in non-relativistic Schrödinger equations for calculation of phase shifts in nucleon-nucleon scattering. At that time there were several papers published on momentum dependent potentials, which are special cases of non-local potentials, which can arise when going from a relativistic description of interactions of elementary particles to a non-relativistic potential scattering formalism.

I started working on the problem of obtaining local but angular momentum dependent potentials equivalent to given non-local potentials in scattering processes, and was able to show that under certain not too restrictive assumptions this could be achieved for a large class of non-local potentials. This resulted in a PhD thesis entitled “Angular momentum dependent potentials, with an application to nucleon-nucleon potentials”, which was finished in the end of the summer of 1966. It was published in two parts in the Danish series *Mat. Fys. Medd. Dan. Vid. Selsk.* **35**, nr. 13 and nr. 14 (1967), and was in June 1967 accepted for the PhD degree at the University of Helsinki. My opponent in the thesis defense was Professor Léon Rosenfeld from Nordita, who had taken an interest in the progress of my work during my stay at Nordita. During that time I had also received very important suggestions in a correspondence with Gerry Brown. I should also mention here an illuminating discussion with Professor Lars Gårding in Lund, which came about as a result of a discussion in Copenhagen with the Chairman of the Board of Nordita, Professor Torsten Gustafson. He suggested that I should get in touch with Professor Gårding at Lund for a discussion of certain mathematical questions which had come up in my work, and which worried me at that time.

I had to leave Nordita after a fellowship of only around 18 months duration in the summer of 1966, since I had to enter into the military service, which was, and still is, compulsory for male citizens of Finland. Leaving the rich intellectual atmosphere of Nordita to become a recruit in the Finnish Army was a cultural shock, from which I recovered in time to defend my thesis at the University of Helsinki on May 24, 1967.

The time at Nordita was full of hard work but also enjoyment, both at the institution and at the social occasions for Nordita fellows arranged by the staff at Nordita, or by the Nordita visitors and fellows. Here I wish to mention especially Professor Alfred Schild from Austin, Texas, who was a very kind and interesting person. He was visiting Nordita during a part of my stay, and was also fond of arranging poker evenings with sufficiently

low stakes that any possible losses were bearable. These evenings sometimes ended in memorable visits to popular restaurants in Copenhagen. Another form of entertainment in which I participated a few times were dinner trips back and forth on the ferry between Helsingør and Helsingborg, a tradition which I believe was started by Ebbe Nyman from Åbo Akademi in Finland, who was at Nordita when I arrived there, and who left at the end of the summer of 1965. He later became associate professor of theoretical physics at Åbo Akademi.

Needless to say, Copenhagen also had much to offer to my family and myself, and we certainly used these opportunities to the best of our abilities.

I have very fond memories of Nordita in 1965-1966, both professionally and socially. I hesitated a little in formulating the title of this essay, since it is debatable whether I was a theoretician when I came to Nordita in 1965. My stay at Nordita certainly was an important factor in making me into a theoretical physicist; an experience which I will always cherish.

Paolo Di Vecchia, Italy, assistant professor 1974-1978, professor 1986-

On String Theory and Other Things

I was at CERN when I saw the announcement for an assistant professor position at Nordita and I applied. I was very happy to get this position that was the first of that type advertised by Nordita, and I came to Copenhagen on May 15th, 1974. I remember coming with the bus from the airport and noticing that nothing was clean and well kept as in Switzerland. From the airport I went to the apartment located at the 10th floor of Rektorparken 10 that belonged to Niels Bohr Institutet and that was taken care of by Fru Hellman who had been the secretary of Niels Bohr.

At that time Denmark was not as rich a country as Switzerland. People rarely went out to eat because restaurants were expensive. Fruits and especially good vegetables, except potatoes and carrots, were difficult to find. There were few foreigners. Travelling with buses in Copenhagen, one would often see old ladies smoking cigars. The lunchroom at the Niels Bohr Institute was located on the upper floor of the C building and I remember that many members of the experimental particle physics group were smoking cigars after lunch in the lunchroom. At that time nobody was worried about the smoke, but this was normal everywhere in Europe.

Since 1970 I had been working on string theory that was born with the Veneziano model in 1968 for describing hadrons but, already in 1972, it became clear that hadrons were bound states of point-like objects, called quarks, and string theory was too soft to explain the behavior of the hadronic cross sections at large transverse momentum that were observed in experiments. Therefore, many people abandoned string theory; in 1973 QCD was formulated and it turned out to provide the correct description of hadrons. Some people, me included, were so fascinated by the beautiful structure of string theory and kept working on it. In 1976 it became clear to me that, continuing to work in string theory would prevent me getting a permanent job. Therefore, after the paper with L. Brink and P. Howe, on the superstring action, I decided to move on to more fashionable developments in field theory, such as instantons and supersymmetry.

The Nordita professor in particle physics was Jim Hamilton who was working with a rather large group of Nordic people on low-energy hadron phenomenology and the Nordita director was Aage Bohr who, especially after the discovery of charm in 1974, wanted to create an environment in Copenhagen of people working on more phenomenological aspects of particle physics. I discussed a lot with H. B. Nielsen and a bit with P. Olesen, but

I was mainly working with L. Brink and a group of Italians who were still working on string theory. The atmosphere at the Niels Bohr Institute was more favorable to string theory than the one at Nordita.

After four and a half years I left Copenhagen at the end of October 1978. I was one year at CERN, one year in Berlin at the Freie Universität and then, at the end of 1980, I moved to the University of Wuppertal where I got a permanent position. Around 1982, I started an extremely stimulating, fruitful and pleasant collaboration with Jens Lyng Petersen who had also become interested in string theory. At the beginning, it was not easy at the psychological level to go back to something that I had to leave, but then, with the help of Jens Lyng, I managed to overcome the psychological problems and I was very happy to be able to continue my research in string theory. At that time I had a permanent position and I could do what I liked most. I must also say, however, that now I do not regret at all to have worked on other aspects of theoretical particle physics as instanton, supersymmetry, the large N expansion in two-dimensional models as the CP^{N-1} model and the $U(1)$ problem. I learned a lot of new physics that turned out to be very useful for my future research.

When Jim Hamilton retired from Nordita in 1985, his position was open for applications. In the meantime, string theory had began to be fashionable again and even more than before. Furthermore, Nordita became more open to more theoretical developments than when Aage Bohr was director.

I applied, was very happy to get it, and on February 1st, 1986 I moved back to Nordita appointed to a permanent position.

I was delighted to be back in Copenhagen which is a great city, and I was also very happy to be able to work again at Nordita especially for its international character. I never liked borders and I always felt a bit in prison to be only connected to a single nation. Nordita gave me the great feeling of being part of all the Nordic world and not just being stuck in a single country.

At Nordita, in the eighties and nineties, we had more or less a fixed budget that came from the Nordic Council of Ministers for our research and for all other activities. We could not apply to the various Nordic national organizations in order not to compete with those working in the various Nordic countries. Apart from our research, we organized conferences, workshops and schools with the participation of researchers and students from the five Nordic countries. These activities could not be organized in a single country because of the small number of participating people located in a single Nordic country, but they were possible at the Nordic level. Through all these activities and my frequent visits to many Nordic universities, I came in contact with the entire Nordic particle physics community, including both

students and researchers. This gave me the great feeling of being part of a larger community rather than of a single university or even a single country for the reasons explained above.

In particular, I had the pleasure to organize summer schools in 1995, 1998 and 2003, with the participation of Nordic master and PhD students. The schools lasted 10 days with 4 hour teaching before lunch, every day on the most recent developments in theoretical particle physics. The afternoons were occupied with study time, question time and also, at the end of the day, with football.

I also had the pleasure to organize two or three master class for Nordic master students on recent developments in theoretical physics.

In the nineties, string theory was a fast developing research field and, in order to be able to follow the various developments, we decided to join the Nordic forces creating a Nordic network of people working in the field. Starting from 1994 we have organized one or two Nordic meetings every year with the aim to learn the most recent developments in string theory. Since 1994 we have organized about 30 of these meetings for Nordic PhD students and researchers.

Nordita in Copenhagen was an independent organization under the Nordic Council of Ministers that organized the Nordic cooperation. Although independent, Nordita lived happily in symbiosis with the Niels Bohr Institute. There was a unique theoretical particle physics group with members both from the Niels Bohr Institute and from Nordita. Also the seminars and the colloquia were in common. The two institutions were functioning very well together.

In the second part of the nineties, the political situation in Denmark and in the Nordic countries started to change. There was a reduction of money used for the same purpose year after year as, for instance, for permanent positions and permanent institutions and an increase of flexible money that could be used for some years for a purpose and for the next few years for other purposes. This meant that my office that was never renewed for many years because of lack of money for this purpose, started to be renewed much more often because there was always flexible money available for this purpose. But this meant also that we had to begin to apply for money from Nordic and European organizations for various purposes and in the beginning we got a lot of extra money showing the high level of the research carried at Nordita. With the years, however, it became clear that the Nordic politicians did not want to keep the Nordic Institutes under the Nordic Council of Ministers and wanted to cut their budgets. This happened around 2006, but this is a new story that has nothing to do with Nordita in Copenhagen.

Thomas Døssing, Denmark, 1979-82

From NBI to Nordita and Back

I started my science activities in the year 1973 during my studies for the master thesis at the Niels Bohr Institute, under the supervision of Aksel Jensen. As I reached some surprising results, Sven Bjørnholm was called in for consultation, and subsequently I presented my results to Aage Bohr and Ben Mottelson. After the master thesis, I had a university stipend at the NBI for the licentiate thesis, and then a postdoc at the Max Planck Institute in Heidelberg. During the years 1979-1982 I was at Nordita. I cannot imagine a better place than NBI and Nordita for being introduced to science.

As a master student at the Niels Bohr Institute I did not recognize that the intricate Blegdamsvej building complex also housed a research institute on its own, Nordita. The first taste of scientific life for me came through the lively nuclear physics seminars Wednesday afternoon in Auditorium A. Aage Bohr and Ben Mottelson were always sitting on the front bench, while Gerry Brown would be present closer to the back benches. Gerry's interests inclined towards a basic understanding of the nucleus from the forces and constituents alone, while Aage and Ben would take the symmetries of the nucleus as the starting point, how the various degrees of freedom generated by the symmetries act out in the nucleus. To a young physicist it was very inspiring to see such different views expressed in sharp discussions. I heard that Ben as well as Gerry were employed at Nordita, and was impressed that Nordita could attract such high-profile scientists.

In the open atmosphere of research at NBI and Nordita, one felt free to start new projects, and it was easy to form groups, working together with the large number of short- and long term visitors, which were always present. For me, inspiration to new projects would mostly be initiated by new experimental results. These results were presented at the weekly experimental group meeting on Monday morning, and discussions would continue in the canteen afterwards. It was at the time of rapid development of gamma-ray detection techniques. Especially, a group at the Tandem Laboratory of the NBI had found delayed gamma cascades, interpreted as being emitted from "yrast traps", and we formed a Danish-Chinese-Japanese theoretical group with visitors to NBI to investigate these states of nuclei. This implied late evenings at the computer, working on results to be presented at talks at home and at conferences and workshops abroad. Both at the NBI and at Nordita I had the privilege of access to Ben Mottelson, who, with his enormous insight

and knowledge, could set our results in perspective and suggest new directions. Gradually during my Nordita time, I started to work with Ricardo Broglia and his group, being inspired by Ricardo's dedication and intuition. Also, I enjoyed the contact with the experimental groups, especially with Carl Gaarde, Jørgen Pedersen and Sven Bjørnholm.

As I was already living in Copenhagen, the shift to Nordita did not seem so significant, but I soon learnt to appreciate the non-bureaucratic way of handling travel and invitations of guest scientists.

During my licentiate stipend at NBI, my postdoc year at Heidelberg and during my Nordita stipend, I became part of an international network of nuclear physicists. I enjoyed discussions with theorists and experimentalists, was invited to give talks at many laboratories and conferences, and I thought that I had covered quite some ground in science. One substantial problem was that I could see that many others had previously done the same, and then still had to leave science after some years. In temporary positions, one asks oneself where will this end up, and it is not easy to explain to the family the wisdom of not seeking more security in employment. Why should't one be responsible and seek a career as a high school teacher in physics and mathematics, which is also very attractive. However, as long as it made fun and went forward through new insight and new results, it was tempting to stay in science for another year.

Richard Epstein, USA, assistant professor, 1976-1983

Memories of an Early Assistant Professor

When Nordita offered me an Assistant Professorship, I felt it would be great to have an extended honeymoon in Copenhagen with my then new wife, Bette Yozell. I already knew Chris Pethick from meeting him in Urbana, Illinois, but except for H. C. Andersen and pastry, Denmark was largely terra incognita to us. Bette and I arrived in the summer, and Copenhagen was enchanting. We couldn't get enough of long walks, swans and Tivoli. The institute was very welcoming. Aage and Marietta Bohr had us over for a dinner party; Ben Mottleson took us mushrooming in the woods; and we had several barbeques at Chris's place. As far as my work goes, I was unsure what I was supposed to do. Alan Luther suggested that I might foster connections between Nordic scientists and those elsewhere. Holger Bech Nielsen cautioned me that sometimes people come to Nordita and don't actually do anything. With this guidance, I sat in my office overlooking Fælledparken and continued my work on supernovae. I collaborated with Henry Nørgaard and Dick Bond, who was visiting with Steve Koonin from Caltech. The supernova research environment livened up quite a bit when Gerry Brown and Hans Bethe showed up. Dave Schramm and I were organizing a workshop on "Supernovae and Neutron Star Formation", and Gerry and Hans figured this would be a good opportunity for them to solve another stubborn problem that mortals had been fussing with for too many years. Gerry threw in some of the students he brought with him (Jim Applegate, Kevin Bedell, Oren Maxwell and Jerry Cooperstein) at this problem. That team together with Jim Lattimer, who was visiting Nordita, made great headway into the supernova problem. Though, to judge from a meeting I attended a few months ago in memory of Stirling Colgate, the supernova problem has yet to be solved. Around the time of the Supernova workshop, Bette and I were busy having our first child, Rebekah. Even though our own parents were in the U. S., we enjoyed warm support from the extended Nordita community, especially Marietta Bohr, Bernard Peters from the Danish Space Research Institute (DSRI) and his wife Hanne. I remember that when Rebekah was born, Bengt and Sigrid Strömberg gave us two flowering plants, one large and one small, connected by a ribbon. Even though the Nordita astrophysics program was not large, it felt lively and productive. We had a weekly astrophysics study group/journal club through my entire tenure. Fellows and students attended and contributed regularly, including Claes Fransson, Åke Nordlund, Henry Nørgaard, Esko Valtaoja, Einar Gudmundsson, and Jes

Madsen. Folks from the Copenhagen observatory and DSRI (the Danish Space Research Institute) often joined us as well.

The astrophysics program had a number of visitors, meetings, workshops and a summer school. At most other institutes, arranging these activities would have been a burden. But, thanks to knowledgeable and efficient support, especially from Hanne Bergen, Helle Kiilerich and Nils Robert Nilsson, these gathering were fun to work on. Our list of long-term guests who brightened up the astrophysics program included, among others, Don Goldsmith, Robert Buchler, Roger Blandford, Gordon Baym, Tommy Gold and Ted Mazurek. In addition to the supernova workshop in 1978, we held workshops in Copenhagen on “Plasma Astrophysics” in 1979, “The Physics of X-ray Emitting Objects” in 1980, “Formation of Galaxies” in 1981, and a summer school in Skutskär, Sweden on “Theoretical Astrophysics” in 1982. Many researchers and students from the Nordic countries and elsewhere participated in these meetings. Some of the outstanding presenters included Andy Fabian, Don Lamb, Bill Press, Dave Arnett, Stirling Colgate, Peter Goldreich, Scott Tremaine, Len Cowie, Catherine Cesarsky, Margaret Geller, Don Lamb, and Bill Saslaw. Additionally, there was a stream of memorable colloquium and seminar speakers who dealt with forefront topics in astrophysics. These speakers included Larry Smarr, Roger Chevalier, Ira Wasserman, Tony Tyson and Arkady Migdal.

The Nordita period was an exciting and formative period for my own research. Working with Chris and Einar, I became captivated by neutron stars. Together with Claes and guided by Ib Lundgaard Rasmussen from DSRI, I became involved in issues of the origin and acceleration of cosmic rays. Jes and I set stringent limits on the mass of the neutrinos based on the observed structure of galaxies, and I attacked some fascinating statistical issues with the formation of galaxies. Beyond the astrophysics community, Nordita also provided an opportunity to make lasting friendships with people in other disciplines. These included Geoff Grinstein, Greger Lindell and his then partner Jette Thy. In all, I look on my time at Nordita with great fondness and appreciation.

Hans Fogedby, Denmark, 1973-1974

From NBI to Harvard, to Nordita

I have had contacts with Nordita in one way or another for nearly fifty years! I first learned about Nordita during my studies at the Niels Bohr Institute in the sixties. During my graduate studies at the NBI in quantum field theory and many body theory I became aware of the august institution, Nordita, with a faculty of foreign scientists, guest scientists, and a group of Nordic fellows. At that time the fields cultivated by Nordita were basically nuclear physics (Ben Mottelson, Léon Rosenfeld, Gerry Brown et al), high energy physics (Jim Hamilton et al.), and astrophysics (Strömberg). Later, condensed matter also became an active field at Nordita (Wilkins, Luther, Hertz, et al.).

As a student in theoretical physics one had a unique opportunity to follow lecture series by Nordic visitors, I recall auditing an interesting course in field theory by Eyvind Wichmann, a visitor at Nordita. I also had the opportunity of getting to know some of the Nordic fellows, I recall hanging around with the late Sjur Refsdal who worked in general relativity with Professor Christian Møller.

The window to the outside world in theoretical physics provided by Nordita clearly stimulated my wanderlust and in 1967 the late Gerry Brown (at Nordita) was instrumental in establishing contact with Harvard, where I obtained a PhD in 1970.

In the early seventies I was a fellow at Nordita. At that time condensed matter was well entrenched at Nordita and I profitted from contacts with Alan Luther and Vic Emery (a visitor at Nordita). Later John Hertz and Chris Pethick also joined Nordita. Altogether an active time in statistical physics and condensed matter.

Later after returning from a position in France at the Laue-Langevin Institute in 1980 and taking up a position at the University of Aarhus, I again started having regular contact with Nordita promoted by a collaborations with Lev Mikheev and John Hertz on problems in non-equilibrium physics. I have also been able to organise and co-organize several international meetings sponsored by Nordita: Two meetings in statistical physics and a joint Landau Institute-Nordita meeting together with Alan Luther. Additionally, I have been corresponding fellows for two periods and served on the condensed matter subcommittee for several periods.

In later years and even into my retirement I have benefitted much from the frequent workshops sponsored by Nordita, now located in Stockholm. In summary, my interactions with the Nordita faculty and staff have always been very fruitful and pleasant.

Bengt Friman, Finland, 1978-80

Several Stays at Nordita in the Late 1970s

After finishing my undergraduate studies at the Åbo Akademi in Åbo, Finland in 1974, Gerry Brown agreed to supervise my licentiate research project. This led to my first contacts with Nordita. For about a year I then travelled regularly to Copenhagen to meet with Gerry for advice on my research problem. Before visiting Copenhagen, I had heard a lot about Nordita and the Niels Bohr Institute from my advisors in Åbo. As most theoretical physicists in Scandinavia of their generation, they had been Nordita fellows early in their careers.

When I had finished my licentiate project in Åbo, Gerry suggested that I join his group in Stony Brook as a graduate student. Thus, in January 1976 I moved to Stony Brook. Nevertheless, the academic year 1977-8 I spent in Copenhagen. Gerry brought his graduate students, Jim Applegate, Kevin Bedell, Oren Maxwell and me, with him for a year at Nordita. It was an exciting year, with many visitors coming through and several workshops and meetings. In particular, I recall that Hans Bethe visited Copenhagen in the spring of 1978. This was the starting point for his and Gerry's work on supernova explosions.

After defending my PhD thesis in Stony Brook in the summer of 1978, I returned to Copenhagen in the fall for a two-year term as a Nordita fellow. My office was on the top floor of the Nordita building, where I was a lone nuclear theorist surrounded by a fine bunch of condensed matter colleagues. At least from my perspective our interactions were very fruitful. As a consequence, I had ample exposure to current problems in critical phenomena etc.. Moreover, I managed to interest one of the fellow "inhabitants" of our floor, Geoff Grinstein, in a nuclear physics problem, namely the role of fluctuations for pion condensation in nuclear matter at non-zero temperatures. This symbiosis of condensed matter and nuclear theory led to a novel approach to this problem.

During my stays in Copenhagen I profited from the broad expertise of the local faculty members and the large flux of visitors that came through the institute. I interacted with the staff and the numerous visitors at Nordita and the Niels Bohr Institute, and established many valuable contacts. I feel that my time in Copenhagen was very well spent and that the experience I gained there has been useful throughout my career.

Einar Gudmundsson, Iceland, 1978-1981

Highlights from My Early Interactions with Nordita

My long association with Nordita started during the Astrophysics Novemberfest, an influential Nordic school arranged by Professors Chris Pethick and Bengt Strömgren in Copenhagen in the fall of 1975. In addition to all the exciting new science I learned at the time, these two weeks in November had a decisive influence on my life. Conversations with the organizers, fellow students and the international team of teachers made me realize for the first time how much the Nordic countries had contributed to astronomy and astrophysics in the past. At the same time, it became clear how much work was still to be done, especially in my own country, Iceland. With hindsight I can now say, that my experience at the Novemberfest was one of the main reasons why I chose to become an astrophysicist, and also why I decided that it might be both satisfying and valuable to work on the development of astronomy and astrophysics in Iceland.

With the support of good people like Magnus Magnusson I became a fellow at Nordita in the fall of 1978. Chris Pethick immediately invited me to work with him, and so did Richard Epstein, the assistant professor of astrophysics. Chris became my mentor and main collaborator, and I consider myself extremely lucky that things worked out that way. Not only is he a first rate scientist, but his enthusiasm, determination and kindness made my years of study at Nordita one of the most enjoyable periods of my scientific life. My main research topic at Nordita was an investigation of the thermal structure of non-magnetic neutron stars. This was a collaborative effort with Chris and Richard, and resulted in a few published papers. With Chris as a mentor I also managed to finish a doctoral thesis, which I submitted successfully to the University of Copenhagen in the fall of 1981.

Now, 36 years later, I am professor emeritus at the University of Iceland. Much of my work here was founded on the wonderful experience and training I got at Nordita in Copenhagen. Continued support from the Nordita faculty, in particular Chris Pethick, and later on also Bernard Pagel and others helped to build up astrophysics at the University. The field is now thriving in Iceland and the astrophysics group has three permanent members (Gunnlaugur Björnsson, Pall Jakobsson and Jesús Zavala Franco). There is also an assistant professor whom we share with Nordita in Stockholm (Gudlaugur Johannesson). Several postdocs and PhD students are presently associated with the group.

John Gunn, U.K., computer manager, 1962-1971

Memories of Nordita's First Computer Manager

On completing my PhD studies in the Department of Mathematical Physics in Birmingham, Professor Gerald E. Brown ("Gerry") suggested that I should apply for a position at Nordita. This sounded like an opportunity not to be missed and I was fortunate in being given a position for one year starting August 1st 1962. Little did I suspect that this would be such a fantastic start of my career – and that I would still be living in Denmark in 2017 with no intention of moving back to England.

I was hired, not as a physicist (theoretical or otherwise) but to assist staff and guests of Nordita and Niels Bohr Institute with numerical computer computation. My qualification for this was work that I performed in my last 2 years in Birmingham with writing computer programs for the Ferranti Mercury computers located in Oxford and Manchester Universities. In addition I had completed the courses in the Mathematical Physics Department. At that time no computer was available at Birmingham University.

In the late fifties and early sixties, Denmark was among the first countries in Europe where electronic computers were designed and built - albeit minute by modern standards. The first use of computers at Nordita/NBI was at Copenhagen University's Astronomical Observatory. Here a GIER computer (complete with teak doors!) was installed and we were allowed access - mostly after normal working hours.

As time went on and use of the Observatory computer rose to the extent that there was not enough computer time available to us and the decision was made to install a GIER computer in the basement of NBI (1966) and a small group of helpers was hired to assist with preparing programs/data on paper tape. Considerable effort was made to provide documentation and small courses in the use of the GIER computer.

In the same period IBM (the dominant computer vendor at the time) made a donation to Denmark with a large IBM 7090 computer to provide computer capacity for higher education institutions in the Nordic countries. The organization that arose was called NEUCC (Northern Europe University Computer Centre) located at the Danish Technical High School (later Denmark's Technical University).

In the late 1960s a small IBM 1130 computer was added at Nordita/NBI. This computer's usefulness lay in its ability to be connected to a telephone line and transmit data at an astounding rate of 2,400 baud (i.e 2.4 kilobit per second in modern computer language)! Later transmission rates reached

9,600 baud. Although experience at Nordita/NBI showed a demand for increasing computer capacity no one expected the demand to increase so rapidly. Shortly after NEUCC was established the consensus among the academic staff was that the IBM computer would be adequate for a number of years and Gerry wrote to the Nordita board saying just this. We could not have been more wrong – rapidly rising demand far outstripped supply!

The Danish Ministry of Education was aware of the need for more computer power in the field of higher education and research and this led to the establishment of two additional large computer centres. A task force was established in the late sixties with Professor Aage Winther from NBI (also representing Nordita) as chairman with representatives from various research/educational institutions and myself on the technical aspects. This work culminated in January 1970 with an invitation to tender for the planned Regional Computing Centre at The University of Copenhagen. This centre, known as RECKU was not part of the University but a state entity reporting directly to the Ministry of Education. The tender was approved by the Ministry and sent out to a number of leading computer vendors and after much travel, demonstrations that were not always successful and lengthy evaluations, the task force recommended that the tender from Sperry Univac (known as SAAB Univac in Scandinavia) be accepted and after Ministry approval detailed planning was started. The neighboring building to Nordita/NBI was available for installation of the computer. I applied for the position as director for RECKU, and was appointed, starting at the beginning of 1972 when operations began.

Gösta Gustafson, Sweden, 1969-71

From Lund to Nordita and Back

I spent two and a half years as a Nordita fellow from the summer of 1969 to the end of 1971. This was a period which strongly influenced my future life; I changed field from abstract field theory to phenomenology, and got lifetime friends.

I started as a young student at Lund University in 1959, and was recommended to start directly with studies in theoretical physics, and follow the lectures of Gunnar Källén. The year before he had left a position at Nordita for a personal professorship in Lund, and begun now to modernize all courses in theoretical physics. Starting in the fall 1959 he lectured the 1-point (first semester) course, followed next semester by the 2-point course, then the 3- and 4-point courses etc.. He was a fantastic teacher, and gathered a group of enthusiastic students around him. His research had been within QED, but was now focused on rather abstract attempts to get enough restrictions to constrain the strong interaction, based on general principles like causality and relativity.

In October 1968 Källén died in an air crash, at an age of only 42 years. This had a dramatic impact on the department, and his students got scattered in various directions. I myself got in contact with James Hamilton at Nordita, and was happy to join his group working on dispersion relations, first with informal visits in the spring of 1969 and after the summer as a Nordita fellow.

I got rapidly well integrated in the group around Hamilton, and in particular I got contacts with the younger Jens Lyng Petersen, Henry Nielsen, and Esko Pietarinen, and with the more senior Geoff Oades. Rather soon also Bjarne Tromborg and Finn Elvekjær joined the group. The work on dispersion relations, as a means to understand the strong force, was much more phenomenological than the field theoretical problems I had been working on before, which actually suited me very well. Although I mainly worked on my own topics, the problems within the group were quite coherent, and the discussions very intense. The yearly “Black Forest meetings” together with Hühler’s group in Karlsruhe, were also always very interesting.

The milieu at Blegdamsvej, with the Niels Bohr Institute and Nordita, was very inspiring, with many interesting seminars and discussions. Besides Hamilton’s group one noticed in particular the seniors Aage Bohr, Ben Motelson, Gerry Brown, and Christian Møller. Besides Hamilton’s lectures I

remember vividly lecture series by Bengt Strömgren about galaxy dynamics, and by Gordon Baym on astrophysics and cosmology. Younger persons active in particle physics, who also were essential for the environment, were Holger Bech Nielsen, Ziro Koba, Paul Olesen, Benny Lautrup, Niels Brene, and Björn Nilsson.

Besides private parties, the social life at Nordita was also very positive, with high points formed by dinner at Strömgren's "Æresbolig" and the lunches in connection with the meeting of Nordita's board.

After my time as a fellow, I returned to Lund, but continued to keep contact with the dispersion relation group and participate in the regular meetings. However, after about five years I got more interested in the new ideas about quarks and QCD, and participated in the development of what became the Lund group in quark-gluon-dynamics. In this work the training in phenomenology I got at Nordita has always been a very great support.

In summary my time at Nordita has given a solid foundation for my later work as a physicist, and given me friends for life. I owe a great deal of gratitude to James Hamilton for his generous support. He guided not only me, but took as his responsibility to assist the department in Lund in the times after Källén's death, taking active part in connection with dissertations and similar departmental issues.

Bengt Gustafsson, Sweden, 1968-70

Recollections of the First Nordita Fellow in Astrophysics

What could “komfur” possibly mean? We read carefully this letter in Danish with all its practical details, from a certain Edith Abrahamsen, guiding our way towards this city in a new country. Yes, we had visited before, been to the fairyland Tivoli and even to the pretty Astronomisk Observatorium in Botanisk Have on a sunny summer day, but now it was real. We should go there for several years, obviously to a flat in the attic of a house in Livjægergade, in Østerbro, with “komfur”.

A few weeks later when we had just made our first Danish breakfast by means of this stove and I had found my way to Blegdamsvej 17, I for the first time met Edith Abrahamsen. She was a heavy smoker with a hoarse voice, keen on helping us but with swift inspecting looks over her spectacle frames. She introduced me to the administrative staff with Stefan Rozental and Helle Kiilerich, the latter whom I successively realized was the key person, in spite of her junior position, to ask for help in solving all sorts of tricky administrative problems such as taxation issues with children allowances, or problems with landlords that did not provide what was promised. Then I was introduced to the Nordita Director, professor Christian Møller, in his office. Møller was sitting behind his large desk, and with a small beard and round glasses. I was aware of some of his work on General Relativity and later followed some of his lectures, but in my memory he is more manifest due to a painful episode from the winter of 1968-69.

The Director kindly invited all fellows with wives or girlfriends (there were no women fellows in those days) and more Nordita staff to his home for a Christmas party. Among the fellows we discussed what gift we should bring on this occasion, and I was given the task of collecting some money and coming up with something. My wife and I found a nice “jydepotte” in brown ceramic in a gift shop, and filled it with gingerbread, the typical Swedish Christmas cookie. The present was appreciated, and a few days later Christian Møller in his kind, almost humble, way thanked me so much, and in particular expressed how delightful the cookies were. Could he (or his wife) possibly get the recipe from my wife? I did not, for some reason, admit that we had just bought the gingerbread package from a nearby Brugsen store, and promised to ask my wife for the recipe with the hope that he would then forget it. But not so, he came up to my office on the third floor in the Nordita building after some days with the same nicely wrapped-up demand. I had then to tell the truth, and he left quite disappointed, perhaps

more with me than with the missing recipe. When we later had to discuss sensitive issues in the Nordita Board, I had the feeling that he did not trust me fully, and I suspected this was based on my gingerbread failure.

I shared office space at Nordita with other fellows, Ole Ulfbeck the first year and Holger Bech Nielsen the second. Ole was quiet and friendly, Holger also friendly but more loudly speaking, indeed so loudly that one could understand even before entering the building that he was in. He had already made a visible mark in particle physics theory by then, and was expected to brighten to a leading star. At times he became a good friend of mine, I always looked him up when I visited Copenhagen later. He paid a visit to Uppsala in return and even made a very memorable guest appearance in a science theatre performance in which I was involved, “The Secrets of the Universe”, at Stockholm City Theatre. There he demonstrated on stage the existence of extra dimensions in an astoundingly concrete way.

An additional friendship that lasted for many years from my first stay at Nordita was with Lars Söderholm, another Swedish fellow who had worked on General Relativity and cosmology before, but now moved towards more fundamental mathematical physics: continuum mechanics. I have since then had innumerable discussions with him on deep questions, in physics and other areas. Also Eivind Osnes, Jens Lyng Petersen, Bjarne Tromborg, Dan-Olof Riska, Gösta Gustafsson and Lars Lundberg were among the fellows contemporary with me. We met regularly, in ‘Frokoststuen’ at the top floor of the old Niels Bohr Institute building, at some lectures and seminars, and sometimes at common parties. But most of us worked together with members and groups at the much bigger Bohr Institute or at other departments like, in my case, the Astronomical Observatory.

The Bohr institute was a very active place, although partially very much still reflecting the grandeur of its founding father. Niels Bohr’s impressive secretary, Sophie Hellman, was still in her office, and in fact she was supposed to go through and correct all manuscripts to be published in the Nordita paper series. My first paper (about stellar-atmosphere modelling) had thus to be scrutinized by her, and to my astonishment she questioned my use of symbols. I had to explain to her that here I did not use them for wave functions but for quadrature weights.

From my first years in Copenhagen I vividly remember Aage Bohr (formally at the Bohr institute) and Ben Mottelsen, not the least when the two of them were sitting together in the front row of the historical Auditorium A and took part in the discussions at colloquia; Bohr timid and rather difficult to hear from the back rows, Mottelsen vividly making his points clear to all of us. Another profile at the Bohr institute was Léon Rosenfeld. He gave a series of lectures in the same auditorium on fundamentals of quantum

mechanics, which I followed. To our great surprise he spent several lecture hours on the psychology of children, and in particular on their formation of fundamental concepts, presenting the work of Jean Piaget and others. This aroused lots of discussion among his listeners; I belonged to the group that, at least in principle, approved the idea to search for the basis of quantum mechanics, and our problems in understanding that theory, within the psychological domain. Maybe, I was also affected by the fact that I was to become a father of our first child within a few months, and took part in a preparatory parent course, encouraged by our midwife who was already appointed by Øresundshospitalet.

Gerry Brown was also a distinguished professor at Nordita whose lectures I tried to follow. With the discovery of the pulsars in 1968, soon interpreted as neutron stars, a surge of interesting activity started around him, in particular with active guests such as David Pines, Hans Bethe, Gordon Baym and Chris Pethick. Among other visitors I strongly remember Vitaly Ginzburg who gave a seminar on “important problems in physics and astrophysics”. It was a very vivid review, where he used his difficulties with the English language as an effective stimulus to keep the young audience alert. When I long afterwards complimented him for this pedagogical trick he said smiling that “One had better use one’s handicaps constructively”.

Among other guests at Nordita were Board members that appeared regularly and previous fellows that visited less regularly. Among the board members was Torsten Gustafsson, professor in theoretical physics from Lund, who had played a central role in establishing Nordita, not the least through his long contacts with the Swedish prime minister, Tage Erlander. I had some interesting conversations with him, also on scientific matters, since he had a background in aerodynamics and I was occupied in devising numerical methods to handle energy transfer by turbulent convection in stars. I remember strongly how upset he was when, in 1971 (after my first stay but during a subsequent visit of mine), he had made the mistake to send a preliminary and not corrected version of the congratulation telegram to his friend Tage on his 70th birthday. A special occasion at which I met other board members had to do with a conflict between James Hamilton, the professor in elementary particle physics, and a fellow.

James Hamilton had been recruited to Nordita in the middle of the 1960s and was a very well established scientist in his area. There were however some tensions between him and younger colleagues at Nordita and the Niels Bohr institute, clearly due to different opinions on scientific matters. Some of these tensions then seemed to be released in a particular issue – should one of the fellows be given additional time at Nordita to complete his work? The whole issue was, and still is, far from my own knowledge and expertise, but

I was involved since the fellows suggested me to represent them and bring the issue forward to the Board. This conflict took place against a rather turbulent background. It occurred in 1968-70, and Copenhagen University was shaken by several severe disputes between students and teachers. One of them took place at the Department of Sociology where my wife, Ulla Arnell, was a research student (she had a Swedish stipend to study city planning and segregation). There, the students and younger staff practically locked the positivist Professor Kaare Svalastoga out of the department he had founded. Now, the Nordita Board allowed representatives for the fellows to take part in the discussion.

Unfortunately, I do not remember very much from these deliberations. I think we arrived at an amicable agreement, but also think that there was a remaining dissatisfaction among the fellows. But what I do remember was the atmosphere at the Board meeting in Auditorium C: the friendly cordiality among the senior gentlemen, the large plates with smørrebrød, beer bottles, coffee and trays with chokoladeboller, all wrapped in in the dense smoke of cigars offered from a box that was repeatedly sent around. This was my first encounter with the Nordita Board in which I would later become a national representative and member. By then, however, the working modalities of the Board gradually had changed.

One of Nordic guests who appeared less regularly was Olle Fröman, professor in theoretical physics at Uppsala. He had worked on tunnelling in nuclear physics with Aage Bohr, which made him a specialist in the WKB approximation, a method to which he devoted most of his life. During his stays he used to live in Nordisk Kollegium at Strandboulevarden. I had a background partly at Fröman's institute, partly at Uppsala Astronomical Observatory, and in fact I was at Nordita on Fröman's initiative. He had early on heard from his friend, Anders Reiz, professor in astronomy at Copenhagen Observatory, that attempts were being made to get Bengt Strömgren, the distinguished astronomer, back to Copenhagen from Princeton. Strömgren was offered a professorship at the University and Nordita, and in addition the Æresbolig (Honorary Mansion) at Carlsberg where Niels Bohr had resided, as a residence. Strömgren accepted in 1967 and I was admitted as a fellow from 1968, in fact the first astrophysics fellow at Nordita.

This brought me into regular contact with an excellent scientist, with broad views, encyclopedic knowledge and a very good judgement. Strömgren served as a mentor to me, and a very good example, rather than a detailed supervisor. He was very generous in presenting the background and showing his own work, even details of it, but he also listened patiently to my presentations of progress and failures, and made many somewhat general comments that I still remember, often use and sometimes cite. On several occasions,

his comments on methodology as well as strategy were remarkably insightful and of key significance for the direction of my future research. Afterwards, when I myself became a supervisor and too much of a committee scientist, I could realise how generous he was in taking part in my worries and first learning steps, while he himself was busy with all sorts of obligations and initiatives in the national and international arena. Through Strömgren, I got in touch with two important collaborators from Århus, Jørn Bærentzen and Poul Erik Nissen. The collaboration with the latter on stellar spectra and abundances was of central significance for the rest of my research life.

At the Observatory, I followed lectures by Anders Reiz on numerical methods. He, and the people at the Observatory, were very early in computer use, with some part in the very origin of the Gier computers and the Algol language. I also had lecture series and practical exercises in Fortran programming and Assembly at the Bohr institute. Towards the end of my stay, I had developed a large computer program for modelling of stellar atmospheres, a code which was sent as a huge batch of computer cards to the Northern European University Computer Centre (NEUCC) in Lyngby every afternoon, and at best come back with the results on paper lists next morning.

Strömgren shared his time between the University Observatory, where he lectured on photometry and spectroscopy, and collaborated in observational projects, not the least with Erik Heyn Olsen, and Nordita, where he gave lecture series on stellar structure and evolution and on galactic dynamics, lectures that reflected the basis for his own research efforts during these years. Strömgren's lecture style was very up-to-date and clear, with a special use of the set of blackboards. Often, all the formalistic reasoning was written in advance on the boards, and then he presented it step by step with oral elaborations and pushing the boards up and down. (I think I never saw him using an overhead projector – sometimes, though, he showed some pictures from books on the antique screen that could be rolled down from the ceiling to the left, using the very old carbon-arc projector in Auditorium A.) Usually a considerable fraction of the scientific staff at Nordita and the Niels Bohr institute showed up at Strömgren's lectures, together with many astronomers from the Observatory. Strömgren obviously had the ambition to strengthen the bridge between astronomy and physics, an ambition he had had already early on in life when he, living at the Observatory, followed the work at the Bohr institute. On one of our rapid walks from one lecture at the Observatory to Nordita, he told me that he knew from his youth that this would take 21 minutes; later on at that occasion he somewhat winded confessed that he sometimes thought that physicists did not understand astronomy very well. When I asked him whether also astronomers could not

suffer from a corresponding lack of understanding, he responded “Yes, but they know that.”

Strömgren and my conversations were all in Swedish, since he, with Swedish parents, mastered an excellent though somewhat old-style Swedish. Otherwise I could have understood his Danish, since I gradually thought that I got some knowledge of this difficult language, even extending far beyond words like “komfur” in the vocabulary. In the very last week of my two-year stay in Copenhagen, Strömgren asked me to give a colloquium at the Astronomical Observatory. When introducing me, he finished his introduction by saying (in Danish): “And now, Gustafsson, we have to ask you to speak Swedish, so that we understand what you say.”

Thors Hans Hansson, Sweden, 1979-81

Memories from My Time as a Nordita Fellow 1979-1981

My first visit to Nordita was in the summer of 1978 – I was a graduate student working at Rutherford Lab, and it was my first big conference. I was down with a bad flu and also too dutiful not to sneak away to Gothenburg for the big Bob Dylan concert. So I was not in a good mood, and what I remember most was that I did not understand much of the talks. But I did get an important message - go home and learn quantum field theory for real! I also distinctly remember coming into Helle Kiilerich's office. I guess I was a bit shy and I had a fever. She looked at me and said: "I guess you want some money". Then she opened the big safe. I was duly impressed and decided that this was a place to come back to.

And I did. In fall 1979 I started as a Nordita fellow. Nordita-NBI in the late 1970s was a great place for QCD. The Copenhagen vacuum had just been proposed and I started to learn quantum field theory for real. The atmosphere was both challenging and friendly, in the afternoons Holger Nielsen was explaining his latest ideas in the coffee room, Predrag Cvitanović was drawing funny-looking diagrams on the blackboard, and there were always lots of guests who gave talks that I after a while started to understand more and more of. I also recall doing something really stupid. Alan Luther was giving a series of lectures on one-dimensional systems. I went to the first, but I could not see what was the point of bothering about electrons in one dimension when there were quarks and gluons in three ... I wish I had!

I started to work with Paul Hoyer who was a senior fellow and had been the opponent on my thesis. I also worked with two of the NBI postdocs, Paul Lauwers and Jeff Greensite, and with Carl Carlsson who was visiting professor. My first year was however not very easy. Several of my projects failed - one because of new experiments, one because of discovering, at a late stage, results predating ours, and one simply because I had missed an important point. But I learned new things all the time, and I also made many new contacts. In particular, I met two people that were to become very important for me in the future. The first was Ken Johnson, the father of the MIT-bag model, who visited Nordita for a year. Together with Carsten Peterson, who was also a fellow, we started to work on problems related to the QCD vacuum. Ken was later instrumental for me getting to MIT, and during the years I spent with him I got innumerable insights into quantum field theory, nicely portioned out during discussions and coffee breaks. At

the end of my stay I also met Gerry Brown, who would later hire me to Stony Brook, and made friends with people in his group.

Copenhagen was a great place to live in. I had moved into a small flat on Amager that belonged to a Danish friend I met at Rutherford lab. But he had been abroad for too long, so he was kicked out, meaning I was kicked out. Fortunately I got a room at Nordisk Kollegium that was a kind of luxury student housing on Østerbro. The move was in fact very fortunate since I made many new friends, and got very good food. I was also lucky to meet Jon Magne Leinaas who was a fellow from Norway, one year senior to me. We got along very well, and we have remained friends and collaborators until this day. We were always discussing, of course physics, but I was on the left, and Jon Magne read Jung, so we also talked a lot about politics and religion. In particular I remember a walk in Fælledparken when he told me about particles that could be “in between fermions and bosons”. It sounded weird, but I must have understood some of it since I remember talking to Frank Wilczek about it when I went with Ken Johnson to Santa Barbara in 1981. Little did I know that I would spend the last 20 years of my career working on problems related to Jon Magne’s funny “in-between” particles and Alan’s one-dimensional electrons.

Nordita was good place for a postdoc, and I cherish my memories of my time there. I did not achieve very much when it came to publications, but I built knowledge, contacts and self-confidence that paid off well in the following years. And there was of course not only physics, but that’s another set of memories.

Per Christian Hemmer, Norway, 1959-60

Notes on Nordita's Significance for Norwegian Physics

Nordita has throughout the years played an important role for theoretical physicists in Norway. Here I will briefly touch on the different roles played by Nordita, seen in a personal perspective. Let me start with the Nordita fellowship program. I came to Copenhagen as a fellow in 1958, merely one year after Nordita was established. It was a wonderful adventure! I felt welcome at Nordita, and both the scientific and administrative staff were extremely helpful in every way. At one time I hoped to take part in a statistical mechanics summer school in Italy. Nordita handled it at once without any bureaucracy: No written application was necessary, ten minutes with the director, Christian Møller, sufficed. At that time there were at the three Norwegian universities no organized doctoral programs, and rather limited contact with what went on in physics elsewhere. Copenhagen, on the other hand, had a long history as a hub for theoretical physics, and we fellows were thrown into an extensive scientific activity. The fellowship program was attractive in several different ways:

- We met other young budding scientists from other universities in our own country, and also from other Nordic countries. Friendships and useful contacts were established.
- The training was intense. In addition to lecture series, in my case by Christian Møller, Ben Mottelson, and Léon Rosenfeld, one had the Friday colloquia, often by well-known experts. Although many of these colloquia could be difficult to follow, they gave us very exciting glimpses from the physics front line. Let me also mention another form of training: I gave, after some initial hesitation, a colloquium on my thesis work in statistical physics.
- Most important, however, were the efforts by the Nordita faculty to encourage and help the fellows to get started on worthwhile scientific projects. The working atmosphere between staff and fellows was very friendly and relaxed. After I had finalized my doctorate, Ben Mottelson came and told me that the experimentalists in Uppsala had a massive bunch of data on how rotational spectra for non-spherical nuclei deviate from the standard formula for rotation of solid bodies. Would I look into this? I would, and I enjoyed very much the project, which resulted in my only nuclear physics paper.

The fellowship program was, especially in the early Nordita years, very important as a mean to transform research neophytes into independent scientists. And the statistics support this. I believe that all of the Norwegian fellows that passed through the fellowship program have made their way into faculty positions in Oslo, Trondheim, or Bergen.

My next encounter with Nordita was a wonderful Nordita conference on statistical mechanics that took place in Trondheim during June 1967. For us it was great to see the well-established celebrities we had read about, like Lars Onsager, George Uhlenbeck, Joseph Mayer, Cyril Domb, I. M. Khalatnikov, Ryogo Kubo, and, for me at least, it was also useful to meet young and upcoming stars like Elliott Lieb and Joel Lebowitz. It was important that the conference was held in Norway, so that many young Norwegian physicists could easily attend.

Nordita's running or supporting topical conferences, summer schools, symposia and workshops has been a very valuable activity, providing graduate student instruction in the Nordic countries. In 1975 I proposed that Nordita should arrange a summer school "Renormalization group methods in physics", followed by a two-day symposium, to take place in Trondheim in June 1976. At the time this field was a very hot topic in critical phenomena. Nordita responded quickly and positively, with promise to cover the expenses for the speakers and for Nordic participants. In addition staff member Alan Luther lectured, and the Nordita secretariat was a great help for the local Trondheim committee. We were able to have excellent lecturers (Michael Fisher, Jim Langer, Harry Swinney, Michael Wortis, Hans van Leeuwen, Pierre de Gennes, and others). The summer school attracted many students, and was definitely a success. In 1984 a Dutch-Norwegian summer school on "Fundamental Problems in Statistical Mechanics" took place in Trondheim. The summer school was supported by Nordita in three ways: A direct financial contribution, economic support of young Nordic participants, and covering of the expenses for Nordita staff member John Hertz, who gave an excellent seminar on spin glasses.

Common for these three cases were two things: First, in addition to their general usefulness as contributions to strengthening Nordic scientific education and research in theoretical physics, for each of them it was an important stimulus for the local group that the meetings took place here in Trondheim. Secondly, the Nordita involvement was handled in a very effective and completely unbureaucratic way. This applies both to the scientific planning and to the administrative help by Helle Kiilerich and her colleagues.

I saw the same effective and unbureaucratic style at the Nordita board meetings when I was a board member and later vice chairman. In spite of its small size Nordita had a remarkable ability to move quickly into new and

emerging areas of science. When I arrived in 1958 the ‘A’ in NORDITA meant Atomfysik, and the main emphasis was on nuclear physics. A considerable expansion came in 1973 when solid state physics was included. Although this step was first proposed by Finland, it was warmly supported by Norway. In a letter to the Norwegian Department of Church and Education the Trondheim physicists Harald Wergeland and Ivar Svare, chairmen of the theoretical physics and solid state groups of the Norwegian Physical Society, recommended strongly this move. Later on Nordita expanded into new fields. Naturally this created long discussions, but I saw at the board always a common will to give priority to science excellence.

The possibility for established physicists to visit Nordita for a shorter or longer period has always been an attractive possibility. My next door neighbour Alex Hansen spent a very profitable sabbatical year in Copenhagen. And some time ago my Trondheim colleague Iver Brevik had several useful discussions with Christian Møller and Léon Rosenfeld. I have only had one longer stay at Nordita, a small part of a sabbatical in 1990. It was, as always, a pleasure to be back in the old atmosphere.

Visits to Trondheim from Nordita staff members and from Nordita guests have also been welcome. Both the board and the staff have, in my opinion, always tried to rise to the responsibility to ensure close contact with the Nordic universities.

To establish Nordita in 1957 was a wonderful idea. And in my retirement I look back at the Nordita contributions to Norwegian physics with great pleasure.

John Hertz, USA, professor, 1976-

Remembering Nordita in Copenhagen

It's hard to decide which events in my 36 years at Nordita in Copenhagen to write about. Thinking back, I remember little things like the primitive phone system we had in the early 80's, where you couldn't ring directly to someone's office, but rather had to call a central switchboard (presided over by a rude woman down in ekspedition given to insulting the language skills of newly-arrived immigrants like me) and ask for an extension number. Some offices shared extension numbers. In my first year, my extension-number partner was Hans Bethe, who sat in the next office. Gevene, my wife, was always afraid of disturbing him (since he seemed to answer her calls more often than I did), so she stopped phoning me except under urgent circumstances.

Then there was the light intensity level in the offices. Or rather the lack thereof, which I tried to alleviate by removing the bottom pieces of the PH-lamper that we were provided, so some photons could propagate directly to the paper in front of me that I was trying to read. But these pieces kept getting magically replaced in the lamps, so eventually I put them in the trash. For this I received a serious scolding from Helle, who told me I was desecrating a national design treasure. Eventually, however, I was allowed to get some proper office lighting in my office, which made it a cheery, bright refuge from the surrounding gloom (for me, at least, though I think the locals didn't appreciate it that way).

And there were the decades worth of board meetings, where I met more interesting and congenial Nordic theoretical physicists than I can count (or than I knew existed before coming here). Throughout most of that period, my colleagues, I think mostly out of inertia, kept re-electing me as their representative on the board, so I think I have experienced more of these meetings than anybody except Helle. In the 80s, these were bigger events in the lives of board members than they are nowadays, when they fly in for the meeting in the morning and leave at 4 in the afternoon to catch another plane home. Members would typically stay for an extra day or so and talk to the stipendiater from their countries. But some changes have been for the better. Back then the board somehow couldn't help wanting to micromanage the operation of the institute, and the situation now seems much improved. Also, in the early days, they used to offer us cigarettes and cigars with our cognac after board dinners, and things have changed for the wiser since then.



Trevor Lamb (then from Cambridge) with John and Gevene Hertz at a meeting on vision organized by the Department of Computer Science, Copenhagen University, 12-15 August 1986.

But my most vivid memories have to do with all the visitors we had from the Landau Institute, thanks to Alan Luther's tireless efforts. My first decade at Nordita was in cold-war times, when Soviet travel restrictions kept Russian physicists from personal contact with their western colleagues. Alan was able to exploit old Bohr-Landau connections and build up an exchange programme that lasted until the end of the Soviet Union, and from which I got a lot of connections and friendships with people I otherwise never would have known. As I write this, I am remembering in particular many hours with Volodya Dotsenko and Paul Wiegmann when they spent a couple months in Copenhagen in (I think) 1986. Paul wanted to take some Amnesty International stickers and literature home with him, and we were worried about whether he might get in trouble if he got caught, but apparently he didn't. Volodya came again in 1989 with his family (Gorbachev had relaxed the rules so families could all go abroad at the same time), and I especially remember sitting in front of the TV in our house with them as we watched

the fall of the Berlin Wall.

With respect to my own research, I will always be grateful for the scientific freedom we had – to work on anything interesting, without worrying about funding. For most scientists it is a risky thing to go into a new field, because it is hard to convince research council review boards that you have a good idea before you have a bunch of publications in it. We were so lucky not to have this barrier, and I think I never would have succeeded in getting established in theoretical neuroscience had I not been at Nordita. I am a little sorry, and worried, that the new Nordita seems to be evolving in the direction of a more normal, grant-funded institution. Nevertheless, I have also had a wonderful time working at Nordita in Stockholm, for almost a decade now, and I hope and believe it will continue to prosper, even though it will not be like the Nordita we experienced and loved in Copenhagen.

Paul Hoyer, Finland, senior fellow, 1977-81

Recollections of Nordita

Nordita is a very special place for me. I have enjoyed the institute during several periods of my research career, here I talk about my period as a senior fellow. In 1977 I was a 32-year old particle physicist joining Nordita after two postdocs in the US (Stony Brook and Berkeley). The position was attractive, being at junior faculty level (3+3 years) in Copenhagen, renowned as a Mecca of physics. I looked forward to joining a Nordic institute, bringing regional responsibilities and opportunities. Several years earlier I had visited the Niels Bohr Institute (NBI) and enjoyed both Copenhagen and the Blegdamsvej atmosphere. I even carried a few Danish genes, my great-grandfather having emigrated from Jutland to Finland. The Senior Fellow positions were a new invention and Fred Myhrer and I were among the first to get such offers. Upon our arrival, there was some confusion as to what these positions actually implied, including the period of employment. At this time Nordita was run in quite an informal way by Aage Bohr as Director, supported by a ‘Professorkollegium’ of tenured Nordita professors. As “young Turks”, Fred and I argued for increased transparency and the inclusion of junior faculty members in the professorkollegium. This was eventually accepted.

Nordita enjoyed considerable autonomy under the Nordic Council of Ministers (NMR). Bureaucracy was minimal. Helle Kiilerich would reimburse travel costs in cash and real time from the safe in her office. Nordita kept its own accounts, which were audited by Rigsrevisionen, the official authority of the Danish Parliament. I do not know of any instance where the trust in Nordita by the NMR would have been usurped. Today, when a globally growing bureaucracy is impeding research, the ease of the Nordita administration remains a fond memory. It demonstrates how significant resources can be freed by replacing centralized control with trust.

Nordita achieved a critical size in its various subfields through integration with the research community on Blegdamsvej. My office was located in the F-building, together with the NBI particle physicists. My daily interactions were with Poul Olesen, Benny Lautrup, Holger Bech Nielsen, Jens Lyng Petersen and postdocs at Nordita and NBI. Predrag Cvitanović arrived soon after me and we shared in both research and leisure. The NBI/Nordita high energy physics group jointly discussed the activities, including seminars, workshops and the visitor program. I also enjoyed interactions with the experimental high energy physics group led by Knud Hansen. With Knud



Paul Hoyer and Holger Bech Nielsen arguing at the XXIII Finnish Physical Society annual meeting at Haikko Manor (Porvoo/Borgå), March 30 - April 1, 1989. (Courtesy Kalle-Antti Suominen.)

we organized two memorable workshops on jet physics, at the time when quark jets were being discovered.

There was an active social program on Blegdamsvej, organized by the informal “Kommutator” society. Potluck dinners and excursions regularly brought together also the spouses and children of foreign guests at NBI and Nordita. The Kommutator may have been an “afterglow” of the fabulous Niels Bohr era. Kommutator activities sadly decreased with the retirements of the Old Guard.

Nordita started an exchange program with the DESY laboratory in Hamburg which had a significant impact on my career. Aage Bohr took the initiative on behalf of Nordita, while Tom Walsh was our contact person at DESY. During 1978-79 Tom made several visits to Nordita, while Per Osland and I made corresponding visits to DESY. The collaboration was motivated by the start-up of the PETRA electron-positron collider at DESY. Osland,

Sander, Walsh, Zerwas and I developed a model for gluon jet production in QCD. Sander provided the decisive contribution by casting the model into a Monte-Carlo simulation program. The discovery of gluons turned out to be the principal contribution of PETRA, and our program was extensively used. The five alphabetically ordered author names were often abbreviated to the first one, so the program became known as the Hoyer model. This must have helped me gain a chair at the University of Helsinki in 1980.

In spring 1981, shortly before leaving Nordita for Helsinki, I got an intuitive sense of a QCD approach to hadrons that I am following to this day (2015). My experiences at Nordita were essential for the emergence of this idea and, in particular, it was Aage Bohr who induced me to turn my studies toward QCD. I am surely not the only one whose career was strongly influenced by their Nordita experience.

Antti-Pekka Jauho, Finland, visitor 1979-81, fellow 1981-84, senior fellow 1992-93

Nordita in the Early Eighties and the Nineties

I came to Nordita in the Fall of 1979 as a visiting graduate student: my thesis supervisor John Wilkins would spend two years at Nordita, and as I enjoyed working with him as well as longed back to Europe, it was a natural step to follow him rather than completing my studies at Cornell with another supervisor. Coming to Copenhagen was a big change from rural Ithaca. This was a vibrant city with many interesting distractions even though the language was very strange. Nevertheless I thoroughly enjoyed my long working days at Nordita and the many extracurricular evening activities. This was an extraordinarily lively time at Nordita. John Wilkins brought his entire group along, there were many visitors of exceptionally high scientific quality, e.g. Dima Khmelnsky, Peter Young and Duncan Haldane. For a graduate student this was a real eye-opener, even though at that time I did not understand much of what these people were saying. I very fondly remember the Tuesday trips to Lund: John Wilkins would take his entire group on a hydrofoil across the Øresund to catch the Solid State Seminar in Lund! Often we would take the slow boat back and have a good dinner there. The social life was very active, essentially every weekend we had memorable parties, and the large influx of people passing through Copenhagen always guaranteed that new people were around. I formed many life-long friendships during this time.

This was also the time of the Soviet - Afghanistan crisis, which prevented direct contacts between the US and Soviet scientists. But Nordita was a safe haven, and many extremely successful joint scientific meetings were arranged at that time. This was a great learning experience. I submitted my thesis in 1981, but stayed as a post-doc for another three years. This was a period of slow maturing: a transformation from a graduate student essentially doing things that one was told to do, to a self-propelled scientist was not easy for me. But Nordita provided the framework for doing this, and this period has significantly influenced my future work. Later in the early nineties I returned to Nordita as a Nordic Lecturer, and these two years were perhaps the best in my scientific career: I had a complete freedom from teaching and administrative duties and a small budget that allowed me to invite some guests of my own choice. I had a huge office right above Helle's office - perhaps the old office of Harald Bohr? - and just the magnificent physical conditions gave a significant scientific inspiration. In hindsight, it is no

wonder that some of my most successful papers were written during that period. Actually, 1979 was not my first visit to Nordita. I believe that in 1955, as a three-year old toddler, I was playing with Tomas Bohr under the table, perhaps in Niels Bohr's Carlsberg mansion, during the meetings when Nordita was initiated. (My father was spending a sabbatical in Lund, and was one of the first board members.) I vaguely remember a photo from one of these occasions but unfortunately haven't been able to locate it. I can thus truthfully say that Nordita has been present during my entire life, and it has been a privilege.

Aksel Stenholm Jensen, Denmark, 1971-73

Nordita Memories

I graduated with a masters degree from the Niels Bohr Institute (NBI) in the summer of 1968. The PhD degree did not exist in Denmark at that time. After one year as a teaching assistant at NBI I went in 1969 to Chalk River Nuclear Laboratories (CRNL), Ontario, Canada. My successful claim was that my degree from NBI was sufficient to qualify me for a postdoctoral position at CRNL. Two years later in the autumn of 1971 I returned to Copenhagen as a Nordita Fellow. Thus, before Nordita I had worked at different institutes with several researchers, I had contributed at several conferences, and carried out research on my own. I had learned a lot but, in hindsight, had incredibly little knowledge and understanding of physics. I felt ready for new challenges, no hesitation, no reservation, no thinking.

Coming back to the NBI-Nordita completely entangled environment was familiar to me after a number of years as student and teaching assistant. I was ready and the scientific atmosphere was perfect for me, informal, freedom to work on self-defined projects, knowledgeable people available and interested in discussions, new undigested ideas put on the table at any time, open discussions, high level but no problem if elaborate explanations were required. We learned much more than we realized in that period, of course about physics in general and the many aspects, but very importantly we learned a lot from the diversity of people with hugely differing background. The diversity of physics and people came about due to the mixture of the NBI and Nordita environment which was a great benefit for the Nordita fellows coming almost exclusively from the Nordic countries. I never thought of distinguishing between NBI and Nordita affiliations and my desk was in a barrack as far from Nordita as possible within the building complex.

The scientists working at NBI-Nordita for shorter or longer periods covered the whole age spectrum from postdoc age and up. All enthusiastic and on a high quality level. There were often colloquia, once or twice a week, and in October 1971 when I started at Nordita the list of speakers counted B. Mottelson, Aa. Bohr, H. Bethe, A. S. Jensen, and G. Brown. I was proud of being squeezed in among these giants in physics. Breaks for coffee and lunch were occasions to meet more than office mates and direct collaboration partners. On the tables in the cafeteria at the top of the tall central building were pencils and writing pads to allow detailed elaboration. This exemplified the engagement, since the scientific discussions of course were taken up or continued over coffee. One morning I was in the line with S. Koonin (MIT

later Caltech), and I suggested a method of removing superfluous degrees of freedom in Hartree-Fock calculations by having one or two parameters to describe core-structure variation. He of course objected and argued. At lunch in the same line he came up and said, I think it is entirely possible. We went on and formulated the idea into a publication. This was an example of how collaboration could emerge without elaborate pre-organized applications for resources. (In passing, the idea showed bad timing since the computer growth made simplified numerical procedures unnecessary.)

Another example of the enthusiasm could be seen at night, for some reason not so often in the morning, both in offices and in the computer rooms. Ideas had to be worked out and tested if possible without delay, also outside normal working hours. Of course it was most often foreign physicists without families one could run into during late hours and nights.

As a Nordita Fellow we were part of the “family” which implied common activities and arrangements. Two examples to mention here could first be the yearly football match between NBI and Nordita where Bohr and Mottelson in some period both acted as goalkeepers for their respective institutes, and second an invitation to an evening in the Carlsberg Æresbolig where the director of Nordita, Bengt Strömgren, resided. Nordita, combined with NBI, was a unique place. The structure, the organization and the scientific atmosphere supported each other. In the end it was the people who did it. I had rather little to do with the administration which really implies that it worked and we could concentrate on our projects.

Scientifically, I was probably in some sense under the responsibility of Ben Mottelson but he never told me what to do. When asked he discussed issues raised and gave his opinion and expectation of possible outcome. It was said at the institute that, although Mottelson had done zero computer work, he had found more programming errors than most people. His physics insight made this possible and we all benefitted from this. Years later it has become much more clear that we learned more than solving specific physics problems. This has surfaced time and again in both discussions and activities related to teaching and research, where some remarks easily hinted that this guy was trained at Nordita-NBI. We picked up a broader view on physics, connection between pieces of information, requesting in-depth understanding, filtering the unessential details away to see the main issue, look for the perspective. The whole physics philosophy was part of the air although never explicitly formulated. The time at Nordita was very memorable, we learned a lot for use both in and outside of physics. As Philip Siemens expressed it on a different occasion, we were taught more than we know. We were equipped for life, and we established lasting contacts. To the best of our ability we have tried to spread the good message by teaching in the same spirit. For all this we are very grateful, it has had a lasting effect.

Börje Johansson, Sweden, 1964-1966

Happy memories from Blegdamsvej

In the spring 1964 I became speechless when I received a letter from Denmark telling me that I had been selected for a two-year stipend at Nordita. This happened when I was only 21 years old and, as a matter of fact, I had never been outside Sweden before. A friend of mine told me that arriving at the central train station in Copenhagen was like reaching the entrance to the Continent, an experience and feeling he claimed was impossible to find anywhere in Sweden. I immediately accepted the offer from Nordita and told them that I should arrive on Sept 1.

In Stockholm I had been working at FOA on neutron scattering problems in nuclear physics. In August FOA very kindly sent me to a nuclear physics conference in Hangö, Finland. This was my first trip abroad, and it so happened that this was to a Swedish-speaking region of Finland. Nevertheless it was very exciting for me since the lectures were generally very good. I had already earlier developed an interest in the many-body problem, and some of the talks in Hangö in fact touched on this subject. I was especially impressed by the talk by Prof. Gerry Brown, who actually worked at Nordita. In his talk he was very careful in referring to the work of his students (Nordita students) and - despite my total ignorance of how academic status can be built up - I noticed that he especially exaggerated the work of the Finnish students. The reason for this was of course that he was speaking in front of an audience dominated by Finns. (Later I learned that several of the well cited Finnish students in due time got good academic positions in Finland.) A good and very well-known book in nuclear theory had been published a year earlier, 'Nuclear Shell Theory' (Academic Press, 1963), authors Igal Talmi and Amos de-Shalit. For me it was fantastic to realize that Talmi was actually present in the audience at this Hangö conference and also during Gerry Brown's talk. At the end of Gerry's presentation Prof. Talmi had a question. He said that he was confused about the appearance of the second term in equation (4) and what it really meant. Gerry immediately answered: I think it means that you have not read your book.

After this of course I wanted to work with Prof. Brown when arriving at Nordita. I decided that I would be brave and directly talk to him about my moving to Copenhagen. One afternoon, directly after a Finnish sauna, Gerry went into the sea for a swim and I approached him in the water. However, I became very disappointed when he told me that next month he was going to Stony Brook, USA, for a longer period, several years. Nevertheless I went

to Copenhagen in September. Then my problem was that I had become totally obsessed by the many-body problem. So I looked around and found Dick Mattuck at the Ørsted Institute on the other side of the park. The problem was that he worked in solid state physics so I had to leave my world of nuclear physics research. In retrospect I was simply too young to understand the boldness of my choice. Think about it, I had arrived at the Mecca of nuclear physics, and decided to become a solid state physicist. Nuclear physics was the most trendy physics subject at the time. On the other hand, and of course I had no clue about this at the time, it turned out that solid state physics was the fastest growing area within physics. And I have never regretted my blind date with solid state physics.

I remember the football matches in the park next to our institute when Nordita played against the Niels Bohr Institute. Aage Bohr and Ben Mottelson were very eager to participate, so the scientific level was really outstanding. The Norwegians were playing very hard-nosed football and I was happy that they played in my team. At this time the world-famous oil company ESSO totally dominated all the advertisement pillars with the great advice: “Put a tiger into your tank”. You could in fact get T-shirts for free being an ESSO fan. Accordingly everybody in the Nordita team became fully supported by ESSO T-shirts and the Norwegians played with even greater dedication.

My office was on the top floor of the Nordita building. The way the offices were arranged was such that it gave rise to the nickname ‘the horse stable’. At the entrance to the Nordita building there were five Nordic swans hanging from the ceiling symbolizing the five Nordic countries. Very nice indeed!! However, such a decoration is totally missing in the new Nordita at Stockholm. I personally feel ashamed about this. Some part of the Nordita feeling seems to have been lost in the move to Stockholm. Sometimes I had my little daughter Elin in a pram next to Blegdamsvej 17, something which very soon helped me to learn to know the personnel in the fantastic international scientific environment originating from the enormous influence of Niels Bohr. Later I persuaded Anders Rosengren and Greger Lindell to become Nordita fellows.

Thordur Jonsson, Iceland, 1982-1983

Impressions of Nordita in the Early 1980s

I came to Nordita as a stipendiat in early January 1982. I still remember my first day very clearly. I went to Blegdamsvej directly from the airport and first had a chat with Nils Robert Nilsson and Helle Kiilerich trying my best to speak the little Danish I knew and had not been exercised for a decade. I used the formal way “De” to address Helle as I learned in school but she corrected me very quickly and explained that this was not really used any more. Then I talked a little to Alan Luther and John Hertz and I still remember how welcoming they all were. When coming to a new workplace first impressions are very important.

Two incidents from my first year are memorable. I wrote a short paper on my own on spin glasses not long after my arrival and took it to the secretary who handled and sometimes typed manuscripts. Her name was Inge Søndergaard, a pleasant but also a very correct lady. I explained to her that I had a fresh manuscript that needed to be typed. She looked at me a bit like a schoolmaster on a pupil and asked whether it had been “approved”. I was a bit taken aback hearing this and Inge told me that Nordita papers must be approved by one of the professors. The local spin glass expert John Hertz was not around so I went to Alan Luther and reported on my exchange with Inge. I remember clearly the slightly awkward smile on Alan’s face when he heard this. Then he took my manuscript and wrote on the title page “OK - AL” without looking at it any further. Alan then clarified the reasons for this approval procedure. I do not think the details of that are of interest now. Then I explained the content of my paper to Alan. The subsequent papers I wrote at Nordita were never approved by anybody as far as I can recall.

The Director of Nordita at this time was Jim Hamilton. He was a slightly distant fatherly figure and I did not meet him until a few days after my arrival. After a few months at Nordita I was sitting in my office one morning doing some calculations. My office mates were not in and around 10 or so there is a knock on the door and in comes the Director. He told me he wanted to know how I was doing, whether there were any problems at the Institute or elsewhere. Then he wanted to hear what I was working on. At that time the research on random surfaces was taking off. I explained the problems but few of the solutions because they did not exist at the time. I was impressed by Hamilton’s curiosity and how well he grasped immediately the problems and why they were interesting. I remember he asked whether

we did not find that the surfaces wanted to grow spikes. At that time it was not clear what the shapes of random surfaces were in the models we were studying but later it was proved that in many models the preferred shape of surfaces is tree-like, just as Hamilton guessed immediately. I remember the Director was not in any hurry and the discussion went on until lunch time.

Keijo Kajantie, Finland, 1963-64

A Nordita Fellow in Lund

I was a Nordita Fellow from January 1963 to December 1964 but located in Lund, not Copenhagen. There was a simple reason for this: Gunnar Källén. And perhaps also the fact that three important characters in Finnish theoretical physics had studied in Lund at the end of forties mentored by Torsten Gustafson: K. V. Laurikainen (my professor in Helsinki), Pekka Jauho (instrumental in Finland joining Nordita and member of the Nordita board from 1955 to 1987) and K. G. Fogel (professor at Åbo Akademi).

Källén of course was a singular character. I attended his lectures in statistical physics and in electrodynamics, perfectly standard basic topics. But Källén's way of presentation was Feynman-like, he derived everything from scratch in his own independent physical way. If I now want to check about diamagnetism in statistical physics or why Bessel functions are what they are, I consult my old lecture notes. Everything is so beautiful and systematic.

Källén had two classes of PhD problems for his numerous students: very formal ones on analytic properties of operator expectation values and very physical ones, kind of preparing ground for the book he would soon be writing. I was very fortunate in getting a problem in the latter class. Swedes were building an about 2 GeV electron synchrotron in Lund (sadly, or perhaps luckily, nothing came out of this) and they were, of course, planning to measure electron-proton scattering. At that time that was forefront science. The new idea was to detect both the electron and the proton and Källén had here a good problem for me: compute radiative corrections for this experimental arrangement. This I did and defended my thesis in Helsinki in early 1965. Others in this class of phenomenology students were, for example, Cecilia Jarlskog and Bengt Petersson.

On the day Kennedy was murdered my wife and I were invited by Cecilia and Göran Jarlskog to their place. She was serving svartsoppa, blood soup.

Some of the technicalities involved in putting together my thesis are memorable. I had a formula for the radiative correction and of course numbers had to be produced. Swedes had downstairs a new machine SMIL, *siffermaskinen i Lund*, the formula was programmed in Algol (Fröberg's creation), written on paper tape, which was then read by SMIL by dropping the tape in a glass walled evacuated box, so that it would move very fast. Really impressive and I loved watching this happen. As impressive was later

to watch the card reader in the basement of building F at Nordita to swallow a stack of 3000 cards ... Likewise quite different from today was how the preprint was prepared: the secretary typed a handwritten draft on wax which was then placed in a machine and copies were made.

Källén was somewhat frightening as an advisor. Honestly, when moving in the long corridor at Sölvegatan 14 I kept a watch on whether Källén would suddenly appear within sight. In that case I hid myself in the spaces in front of the doors. Sometimes this failed, then Källén took me to his office, put me in front of his immense blackboard, gave me a piece of chalk and told: now tell me what you have done. Of course I understood the positive side of this approach, I often hear graduate students complaining that they have great difficulties in contacting their advisor. If I had nothing to say, Källén took the piece of chalk and started computing himself.

With hindsight one can say that what Källén then was famous for, his way of solving QED and analytic properties of n-point functions, is not as well known and important today. It was doubly tragic that he died just when the standard model was born. He had definitely done great things when using his computational abilities to solve phenomenological problems within this concrete well defined theory.

I have a very pleasant memory of the atmosphere at the department in Lund. Each room had even a bed and there was a guest room on the top floor. There was one initial problem, though. I came with reasonably good school Swedish and when I first entered the coffee room I was puzzled by the nationality of the people sitting there, they seemed to talk a language which I could not at all recognize, maybe it was one of the Baltic languages. Well, it did not last long until I realized that they were talking plain Swedish just pronouncing it in a way I never had heard in Helsinki.

I was living in Lund but, of course, visits to Nordita in Copenhagen were frequent, approximately once per month. The ritual is etched in my memory, first a walk to the railway station in Lund, then train to Malmö, walk to the ferry, then a some 3 hour crossing of the Øresund, then a walk to Nordita. It was a relief to get there. And on the way from Nyhavn to Nordita I always stopped at a counter and bought “to pølser med brød”, two of these marvelous red sausages. In later years lunch at Nordita was an experience in itself and worth a trip, at that early time one had to go and buy something from the other side of Blegdamsvej – but how could I know what to ask for?

Times were different then: I have a postcard from T. Dahlblom at Nordita who writes that this is not for me but for my roommate, he asks if you could bring some chocolate from the boat, it is so much cheaper there.

Usually I visited the Finnish colony at Nordita: Kurki-Suonio, Kallio,

Mustelin, Tarjanne and, in particular, Eero Byckling, with whom I even started joint work. Ultimately in 1973 this led to the book “Particle kinematics” which we coauthored. Bjorken was there and since I worked with QED I climbed upstairs to his office to discuss. We did not get very far, Bjorken was maybe as shy as I. But very useful were Gerry Brown’s lectures on the group $SU(3)$, he was giving them “to learn about $SU(3)$ ”.

Benny Lautrup, Denmark, 1965-67

A Stipendiate in the 1960s

In the spring of 1965 I was writing a thesis on Quantum Electrodynamics for the ‘magister-konferens’, roughly corresponding to today’s PhD. It was to be finished in June. On March 30, I applied to Nordita for a stipend, describing my thesis in merely seven lines, corresponding to about 70 words (!). The stipend was granted by the Nordita Board on May 12, for the period from July 1, 1965 to August 8, 1967, but I do not think I was told about it at that time.

The central topic I had chosen for my thesis was ‘Quantum Electrodynamics in Covariant Gauges’, and the thesis was formally accepted by the Niels Bohr Institute in June. The rules demanded, however, that the degree would first be awarded after I had given a public lecture on an unknown topic (chosen by my advisor (Aage Winther). In this case the given title was ‘Some recent experiments on quantum electrodynamics’. This topic was deliberately chosen orthogonal to my highly theoretical thesis, but I quickly checked the recent journals and found what I needed. Having given this lecture I seem to remember that Professor Møller, then the director of Nordita, came up to me after the discussion, and asked if I would like to work at Nordita. I agreed on the spot, and as far as I remember, he said: “Then you can begin on Monday”. Formalities were not very extensive at that time.

Some of the new stipendiates were placed up under the roof of the Nordita building in small, or rather tiny, cubicles with room for a chair, a small desk and a small bookshelf. In the summers it could get quite hot in those offices. Being away from the Nordita professors and the guests, we formed quite a lively - sometimes childish - group with laughter and practical jokes, at the same time being serious about physics. I was not explicitly coupled to any of the professors but essentially left to my own devices. I think that reflected the Nordic philosophy of how to do physics at that time.

Jon Magne Leinaas, Norway, 1978-1980

Impressions from My Period as a Nordita Fellow in Copenhagen

It was early September when I first arrived in Copenhagen and found my way to Nordisk Kollegium. I was excited and anxious thinking about the two years ahead, to live at this college and to take part in the activities at Nordita and the Niels Bohr institute. The installation at Nordita was soon done the following day, and my impression then and later was that with Helle Kiilerich as the excellent leader, the administration was able to handle all things there in an efficient, non-bureaucratic and friendly way.

I found that there were no walls between people at Nordita and the Niels Bohr institute, so that the two together functioned as one large Institute for Theoretical Physics. It had its Nordic side, with Fellows and visitors from the Nordic countries, and its international side with postdocs and visitors from all over the world. And we were all mixed in the offices and in our activities. This combination I found to function very well, with Nordita being an important meeting place for Nordic physicists and also a place to find new contacts at the international level.

There was an initiative, soon after I arrived, to strengthen the communication between senior and junior people at Nordita, by creating a set of small groups where one of the senior people discussed a particular subject with a small number of fellows. This was the reason that my Swedish co-fellow Petter Minnhagen and I had the good fortune to have a series of meetings with Aage Bohr, where he explained and discussed with us the ideas behind superfluidity in atomic nuclei. This was both inspiring and informative for Petter and me, and we enjoyed much these friendly meetings with this Nestor in nuclear physics. The results of the meetings we summarized in the Nordita preprint 'Pairing (or superfluidity) as experienced by the nucleus'.

This was a time with a lot of activity in the development of different aspects of quantum field theory, both in general, and in the application of theory to measurable effects in experimental particle physics. Some of the interest was aimed at the understanding of topological effects in these theories. This was interesting for me, in particular since I had been applying ideas of topology in a paper the year before, with Jan Myrheim, where we discussed the possibility of having particles with statistics different from that of bosons and fermions, provided these particles were constrained to move in only two dimensions. I explained these ideas in a seminar I gave at Nordita, but it took a few years before this idea received broader attention.

A young mathematician, Bjørn Felsager, who gave a series of lectures at Nordita, I found to be excellent in explaining the mathematics of geometry and topology to physicists, and I had the pleasure both to discuss with him and to publish two papers with him. Towards the end of my period as Fellow at Nordita I collected my papers on geometry and topology in a doctoral thesis ‘Gauge Fields and Geometry’, which I defended at the University of Oslo.

For me it was very convenient to live at Nordisk Kollegium. It was only a short walk from the Institute, and I had all my meals served there. The breakfast was served in the morning, I had the lunch brought with me to the Institute, and we had a common evening meal at the college. It was good food, and all was very pleasant. I also got to know well the students on 1. syd, the corridor where I had my room. This was a very social group, and we met in the kitchen for an evening beer and occasionally went on Sunday hikes together somewhere in the attractive surroundings of Copenhagen. This definitely added to the positive feelings for these two years in Copenhagen.

The second year I got acquainted with another Swedish Nordita Fellow, Hans Hansson, who later also moved in at Nordisk Kollegium. We very soon came into the habit of seeing each other for discussions on physics problems and all kinds of other subjects, often on walks in Fælledparken during lunch breaks, or on Langelinje in the evenings. This turned out to be a lasting friendship, and we later have continued to work together on a series of physics problems.

For me the period I stayed in Copenhagen was both pleasant and profitable scientifically. I found Nordita to be an inspiring place to work. In a sense the important historic events taking place here during earlier periods were still felt present in the walls. And still the place was a very active physics center, with a lot of interesting research going on. I should add to this that Copenhagen itself was felt as a very friendly and attractive place to be. This was not only my view, but that of all the people working at Nordita and the Niels Bohr Institute, I believe.

Greger Lindell, Sweden, 1975-77

Nordita Memories

It was almost exactly four decades ago that I had the great opportunity to spend two years at Nordita in Copenhagen. Years of immersion in physics, challenges and work. Not least ('ikke mindst' in Danish. Why is this such a popular Danish idiom?) a time of interaction with people, ideas and environments that came to influence my life beyond what I had expected. After all, I finally spent almost three decades in Denmark following my Nordita years, none of them in the field of physics but all of them profiting from my background in physics from Nordita and the years before at Uppsala University, ETH in Zürich and Linköping University. I will try to share some of my memories that I hope can be of interest not least (again!) considering the length of time that has passed since then, concentrating on the impressions and the people that I met. Memories are, like quantum particles, difficult to pin down. Still, I will do my best while not claiming to be historically correct or complete. For example, I have discovered that I remember some people without being able to bring up their names; sometimes I remember names but not the corresponding faces in the Heisenberg way. The result that follows at best a collage.

TRIA 16 16 was my first surprise. I was surprised to learn that the institute for atomic physics was reached by a manual telephone exchange at KTAS (Copenhagen Telephone Company). It was also one of my first encounters with Danish language pronunciation. The Danish language was, initially, no big obstacle for me thanks to my Swedish mother tongue. Pronunciation was another matter altogether and this was one of the simpler examples. After all, only the letter A is rewarded with several pages in the Danish dictionary due to the different sounds that it can represent. I later lived in a Copenhagen suburb where the spoken word "pocket calculator" can be mistaken for "sheep counter". Many of my fellow Norditaites were trying hard to learn the language. They had two choices: KISS and Studieskolen. KISS prioritized the pronunciation with a quite distinct result, and you could fairly easily distinguish their students from the others. Danish at the time had a disarming characteristic since they used words related to food as the basis of slang and expletives, such as "Fedt mand!". Tangentially, I also remember some people's enthusiasm when they fell over the Danish specialty "Ymer mit Kvark" in the supermarket, thinking it was a physics-inspired Danish specialty from Massachusetts. Copenhagen was quite special at the time. Christiania was "liberated" and started making their ubiquitous bike

modifications, Other bikes had the funny little Solex combustion engine on the front wheel. B&O was the rising producer of beautiful HiFi. The famous designer Jacob Jensen who created the B&O look recently died on May 15 2015. There was an obituary in the May 22 issue of the New York Times with a picture of the iconic turntable with a parallel arm movement. Financial Times also published an obituary. The famous smørrebrød restaurant by the lakes had the longest menu in the world and winter skating on the same lakes was still possible. A florist bought the B&W wharf. The Spies (eat) travel agency was open 24 hours every day and a priest from the provinces ran its biggest competitor. There were two competing supermarket chains. Irma was a little more up-market and had a gigantic neon sign on a facade facing the lakes. It was showing a hen laying eggs. Brugsen was the cooperative competitor whose gigantic neon on Rådhuspladsen simply said “Brug Brugsen” (“Use the User Cooperative”). A colleague from Canada once told me his father, on seeing the sign, said that he envied that fellow Brug whose name was so prominently placed (Try to pronounce it the North American way without understanding any Danish).

As you may know, the Swedish-Danish relationship is a bit peculiar as the two countries were more or less at war for several hundred years, at that time only extending into the football games. A Danish acquaintance of mine wrote his doctoral thesis on the differences between the Danish and Swedish kitchen sinks. Differences are profound indeed.

Helle’s office was big and had a great atmosphere, her colleague Vivi contributed as well. It was one of the first I entered and one of the last I left when I said goodbye to her as I left for my job at IBM. I still remember her remark about watching those ‘perfect people’ stepping off the local train, also called the pig, on their way to the IBM headquarters in beautiful Lundtofte. My own desk on the first landing was one of many special corners in the building – I was told Niels Bohr had actually designed it himself. Soon after I had sat down, I had a nice surprise as an old friend from Uppsala, whom I had not had contact with for some time, appeared – another Nordita scholarship postdoc. A short corridor and a few stairs down led to the RECKU terminal, where I would spend many days and evenings, saying hello to the night watchman. His control key was hanging on the doorframe. Evenings because I was using the cheaper night rates on the mainframe. Even avoiding payment altogether by chaining jobs – saving and restarting – just before the free-time limit. A few very likeable Chilean postdocs arrived from Cornell planning to run their calculations on the computer. They never adjusted to Danish time. Instead, they profited from mainframe availability during the nights. Computer facilities were very impressive to me as I was used to giving my punch cards to the friendly lady at the punched card

terminal in Linköping, who dialed in to the Lund University computer. She told me that once she had dialed the wrong number by mistake and started transmitting data to the completely unsuspecting person who had picked up the phone. No such problems here but we still had to pick up the print output in another building which we reached through the underground tunnels. It was a band printer next to a mini computer (PDP?) which I never used except a few times when I played the moon lander game. The removable data discs had a 5MB capacity and were as large as family pizza boxes. Speaking of computers, some people had their own super pocket calculators attached to their belts, ready to draw and calculate. Still today I use variations on my RECKU login as passwords! Besides computer printouts, my desk was covered with copies of physics journal articles made on the big copier near the printer room. It had a cylindrical glass plate and produced flimsy copies on grayish papers.

My colleagues, a fascinating group from many countries made my stay very pleasant and interesting. There were the junior scholarship postdocs, mainly from the Nordic countries as well as more senior and renowned researchers from all over the world. The Chinese I remember but never talked to, in my impression they kept to themselves. A very friendly Russian scientist liked to give parties as he bought cheap whisky at his embassy and told me funny stories about his compatriots. I waved him good-bye at the train station together with his KGB escorts. Ben Mottelson (often arriving on his bicycle) and Aage Bohr received the Nobel Prize that winter. Big excitement and champagne surprised in the hall. A pleasant memory. In my mind, I connect this event with the big reception at the Louisiana Museum of modern art in Humlebæk. The whole museum turned into a cocktail-snacks-party hangout for physicists!

I spent most of the free time with some friends from Nordita, some from Europe, including Switzerland, some from the US. There was the very charming, talkative and loud professor from Cornell who seemed to know everybody. I especially remember my first Christmas when a group of these friends made a truly international dinner in his apartment. This was not my first Christmas in Denmark. A few years earlier, I had planned to celebrate in Lübeck, Germany, together with a colleague from the institute in Uppsala. As we had forgotten our passports, we watched the ferry leave from Rødby and moved the celebration to Nykøbing F. I really appreciate how much easier it is to travel in Europe today.

Nordita had an excellent service for finding furnished apartments for rent, the Cornell professor finally stayed in a fantastic apartment above Gråbrødre Torv. Even more excellent, if possible, was the wife of our Swiss colleague looking for a place for herself and a place for her kiln - she was a ceramics

artist, she also found a fantastic apartment for me on Christianshavn on the canal. A group of architects just out of the academy had bought a whole quartier of very old run-down houses, individually of course. Then they had restored them, some even with their own hands, cleaning the original bricks for authenticity. My living room floor tilted since Bente, the architect, claimed it was the original fashion to make it easier to clean. I finally stayed many years in the same street, only moving to a bigger apartment when my first son was born. One of my colleagues, the Canadian who became a very good friend, also stayed in the apartment for quite some time since he was on his way to the IBM research center in New York and was anxiously waiting for the necessary visa.

Lunch was sometimes in the small cafeteria with the famous notepaper on each table, very stimulating. When the weather was good, we would buy vegetables at the grønthandler (greengrocer) across Blegdamsvej and eat in the big park, Fælledparken, behind the institute. At Irma, the supermarket, we would also buy our favorite wine, the Vouvray, white wine of the dry and fruity variety. I have since made a point of visiting the wineries in the Loire valley, whenever I could. The Copenhagen drinks are otherwise mainly Beer as I saw on a sign outside a typical local brasserie: “Today’s lunch: Three Tuborg”. This relaxed attitude to alcohol in Denmark reminds me of another colleague who marveled at the sight of a large poster advertising cherry liqueur: “This could never be shown in Sweden”. Boats, ships and hydrofoils “flyvebåde” were all the time an important part of Copenhagen at the time. The flying boats reached Malmö quickly and in style and even had stewardesses. The slow boats made the trip over a lunch. The most outstanding were the Oslo boats, which left – and still leave – Copenhagen right before dinner and sail through the night arriving for a breakfast in the beautiful Oslo fjord. All the while trying to spot the place where Norwegian coastal artillery sank the German cruiser *Blücher* in the early morning of April 9, 1940. Most of the Nordita team travelled on the Oslo boat to a midsummer conference in Norway. We had been convinced to make a pre-reservation for a group dinner including drinks, being the most economical alternative. It was a splendid meal until the desert arrived accompanied by the waves of Kattegat. A rout commenced, leaving a small number of hardened individuals arguing with the staff to cancel the large number of pre-ordered cognacs. The law of the sea apparently makes it impossible to cancel food and drinks because of bad weather (see. “Three men in a boat” by Jerome K. Jerome). Keeping a stiff upper lip, the brave negotiating team proceeded to take it upon themselves to ensure that the money was well spent. Trondheim is a beautiful city and Norway’s Technical University welcomed us warmly. Besides the conference itself, we discovered that we

had arrived in time for the Norwegian midsummer celebrations. The main activity turned out to be spending the night in the forest with an open fire. This we proceeded to do even though there was a mild summer shower. So many years later, I don't remember much except for some reason there was a competition who could put a whole fist in their own mouth. The wife of one of the Norwegian conference participants impressed everybody by her performance.

We had a few popular places where we used to gather, such as “Galathea Kroen” (Blue curtains?) and the jazz bar “The Three Musketeers”. I remember the latter in particular since my good friend from Sweden met his future wife one time we were there. Myself, I met my future wife at Triangelen, the TR in TR 16 16. I also remember when a large group of physicists had dinner at a pizza restaurant on the corner of Vor Frue Plads – I just checked, it is still there. After the dinner, the Italian waiter presented us with a hand-written bill and all the mathematicians refused to believe it. Grabbing various notebooks and pocket calculators, we attempted to reconstruct and recalculate the dinner. After intense study, we had to admit that the end result turned out to agree with what the waiter had produced. Embarrassment. The episode reminds me of the “Italian waiter calculus”, described in “The Hitchhiker’s Guide to the Galaxy” as essential for constructing a faster than the speed of light spaceship.

Magnus Magnusson, Iceland, 1958-1960

Memories of the First Icelandic Fellow

After studying physics and mathematics at the University of Cambridge and working on the calculation of wave functions using the first computer in England, EDSAC1, I spent a year at Princeton University. Coming back to Iceland the situation was very different from Cambridge and Princeton. There was no physics department at the University of Iceland, only physics courses in the first part of the (Danish) engineering studies. I attended the first UN Conference on Peaceful Uses of Atomic Energy in 1955 as a representative of Iceland and became director of the Icelandic Nuclear Science Committee which was established the following year. I was fortunate to get a fellowship at Nordita in 1958. I arrived in Copenhagen in the autumn of 1958 with my family. Nordita had arranged for me to rent a house in Sorgenfri, on the same street where Aage Bohr and family lived. We got to know Aage and Marietta Bohr well and the children of both families could play together. Around 1970 Aage and Marietta came with their son Tomas and daughter Margrethe to Iceland. My wife and I took them to the site of Njal's saga. At a spot where a fateful event occurred in the saga we had a picnic and Aage read aloud about this event from a copy of Njal's saga from which Niels Bohr had read to his children.

I had long been interested in General Relativity but had not had the opportunity to follow up that interest. At Nordita, however, I got the opportunity to work with Christian Møller on the energy-momentum complex in General Relativity. This gave me the opportunity to attend conferences on General Relativity during my stay at Nordita and after I returned to Iceland. At these conferences, I met many scientists whom I would not have met otherwise and the lectures gave me a good overview of research in General Relativity. The atmosphere at Nordita and the Niels Bohr Institute was scientifically very stimulating due to the staff, fellows and visiting scientists from all over the world, some Nobel Laureates and some Nobel Laureates-to-be. Of the former were Werner Heisenberg, P. A. M. Dirac, Julian Schwinger and Abdus Salam, whom I had known in Cambridge. Once during Heisenberg's visit I was standing on Blegdamsvej waiting for a tram when I saw him in Niels Bohr's office and Bohr walking around the room. I then recalled the story of their famous meeting, probably in the same office, during WWII, which Aage Bohr had told me about. The social life at Nordita and the Niels Bohr Institute was most enjoyable, both at the Institute and in private homes, e.g. at Aage Bohr's home and Christian Møller's home, where I had

the pleasure to meet Werner Heisenberg. One event was particularly memorable. That was the Christmas party for families of foreign scientists held at the Carlsberg Æresbolig where Niels Bohr spent much time showing the children the magnificent Christmas tree while Margarethe Bohr entertained the parents.

Back in Iceland I got a position at the University of Iceland and was given the task of setting up the Computing Centre at the University, among other things. When the Science Institute (of which I became director) had been established at the University in 1966, and a B.S. programme in physics and other subjects was set up, the physics community started slowly to grow with the staff at the Science Institute and the gradual increase in the number of physics students.

When I became a member of the Nordita Board in 1973 Nils Robert Nilsson, Helle Kiilerich and I arranged for members of the Nordita staff and visiting scientists to come to Iceland and give lectures at the University. Of the Nordita staff I can mention Bengt Strömgren, Christian Møller, Aage Bohr, Ben Mottelson, Chris Pethick, Alan Luther and Nils Robert Nilsson. Of the visiting scientists I can mention Gordon Baym, Thomas Gold, Peter Havas, Donald Q. Lamb, William H. Press, and Herbert Schnopper. These visits and lectures were most stimulating for the small scientific community in Iceland and encouraged some physics students to go abroad for further studies, some getting a fellowship at Nordita. When they came back to Iceland they got positions at the Science Institute and eventually were appointed to positions at the University. Thus one can safely say that Nordita had an important part in building up studies and research in physics in Iceland.

Matti Manninen, Finland, 1979-1981

Nordita Memories

I was spending my first postdoc year in Michigan Tech, in 1978, when I got a phone call from John Wilkins, asking if I would be interested in working in his group at Nordita. I told John that I had earlier applied for a fellowship without success. John replied that this time I would get a fellowship. I was wondering how a Cornell professor, whom I had never met, wants to work with me and, moreover, is able to arrange a position in an institute he was only going to visit for two years.

Looking back, it is interesting to see how much my future life was affected by that phone call, and the two years I spent at Nordita in 1979-1981. Nordita appeared to be a dreamworld for doing research: No other duties, lots of famous visitors, many workshops, good administrative support, unlimited travel money, and even good parties.

At that time my research interests were metal defects and surfaces. I worked with Jens Nørskov, Cyrus Umrigar and with my earlier collaborators in Finland and in USA. I shared an upstairs office with Antti-Pekka Jauho. Quite often Antti-Pekka and I disappeared for two hours – to play badminton or tennis in Svanemøllehallen.

When I left after two years, Nordita lost one of its secretaries, Elsebeth, who has been with me ever since. Meeting Elsebeth was the greatest thing that happened to me at Nordita. However, also other connections I made at Nordita affected my future life. René Monnier convinced me to take a postdoc position at the Swiss Institute for Nuclear Research. In 1984 John Wilkins surprised me once more with a phone call, this time inviting me to Cornell University for two years.

In 1988 I finally got a permanent position, at the University of Jyväskylä. At that time I was the only faculty member in Jyväskylä who was not working in nuclear physics. Thus, everybody at the department was surprised when Ben Mottelson asked me for a longer visit to Nordita. Ben was interested in metallic clusters, which at that time was my main research area. My family started to spend every June in Copenhagen. In summer 1992 Sven Bjørnholm asked if I would like to spend a sabbatical at NBI and live in Nyhavn, in the same house H. C. Andersen had lived. Sven succeeded to get for us this fantastic apartment owned by Danmarks Nationalbank and we spent the academic year 1993-1994 in Copenhagen. I had a great office at the NBI library (Elsebeth called it Strömngren's office). Copenhagen started to be my second hometown.

My student Matti Koskinen came to Nordita in 1994 and this started a long lasting collaboration with Stephanie Reimann, who later came to Jyväskylä as a Marie Curie fellow. Stephanie revived my connection to Nordita, this time working on quantum dots and quantum gases, together with Ben Mottelson and Susanne Viefers. When Stephanie got a permanent position in Lund my trips to Copenhagen became again more frequent. In the summer 2001 Stephanie and I borrowed Chris Pethick's office for a week in order to finish a review paper, which eventually became our most cited paper (Rev. Mod. Phys. **74**, 1283 (2002)). Elsebeth and I had rented a summerhouse in Liseleje, where we had a holiday afterwards. Working with Stephanie and Ben was great fun and it continued until 2012, when I became a rector of the University of Jyväskylä.

As a member of Nordita board in 2002-2010 and especially as the chairman of the board I experienced the turbulence of moving Nordita to Stockholm. I remember the many short visits to Copenhagen, either leaving home at five in the morning and returning after midnight or staying a night in hotel Maritime. When Nordita moved to Stockholm the board and the duties of the board did not change markedly. Nevertheless, everything was not the same: I missed the boller med smør and wienerbrød we used to get with coffee, as well as the splendid Danish lunch at the NBI cafeteria.

René Monnier, Switzerland, visitor 1975-1977

Solid State Physics, Fondue and Ceramics

After a long drive from Neuchâtel, Ruth and I found Blegdamsvej 17, squeezed between the Frimurerordenens stamhus and Rigshospitalet. We rang the bell, and the door was opened by Helle, who held a big cigar in her hand. “We are the Monniers from Switzerland”, I said, upon which she turned her head and yelled into the building “The Moneys are here!” We were puzzled by her reaction until we learned that the small container we had rented to transport our modest belongings had been brought to Nordita instead of waiting for us at the railway station, and our stuff was distributed all over the place at the worst possible moment, as they were in the middle of the preparations for a conference. Among the goods were sixty bottles of red wine, because we had been told that Scandinavians were beer drinkers only. Fortunately, we were never arrested for smuggling alcohol into the country!

I was part of a new program on condensed matter theory, initiated by John Wilkins. We worked hard at pushing the frontiers of science, but there was also time for parties. On one occasion, we invited the group for a cheese fondue to our apartment on Nygaardsvej 22, across Fælledparken from the institute. We didn’t have the necessary equipment, so Ruth called the private residence of the Swiss ambassador, and said that we had invited international scientists from the Niels Bohr Institute for a fondue and desperately needed ‘caquelons’ and ‘réchauds’. An hour later, she could pick them up in Hellerup. Cheese fondue should be creamy and smooth. Ours didn’t have these qualities for very long. About half way through, the cheese would come in the form of long and very strong elastic strings, which had to be cut with scissors.

Life was particularly exciting during the period in which our Russian colleagues from the Landau Institute were visiting: they could buy unpasteurized Czech beer, Georgian cognac, Cuban cigars and, of course, Russian vodka from their embassy. So, on those Fridays on which they did their ‘shopping’, we would all meet late in the afternoon and enjoy the bounty. My office mates, John Perdew, with whom I had a very fruitful collaboration, and Bob Albers, loved the Cuban cigars, which they couldn’t get in the US because of the embargo, and very soon, our room was turned into a smokery.

Copenhagen was professionally not only interesting for me but also for Ruth, who was a photographer, actively interested in ceramics. She was able

to fulfill her wish to work with Gunhild Aaberg, at Strandstræde Keramik, and an unforgettable collaboration and a lasting deep friendship developed.

Following Chris Pethick's and Gordon Baym's advice, I signed up for an intensive Danish course at a school they recommended. The program was really tough. Twice a week, we had to learn ten sentences by heart, and if we failed, the portion was doubled! I remember waking up in a sweat in the middle of the night, with the words "Der er ti kopper på bordet" on my lips. At the end, I had an acceptable glottal stop!

Fred Myhrer, Norway, 1977-1981

Memories of Nordita

The four years my family and I spent in Copenhagen were full of surprises and some happy memories. We especially recall the generous offer of Mrs. Yvonne Rosenfeld to lend us her retreat on the north shore of Zealand one Easter. It was a delightful cottage in very peaceful surroundings, which we all appreciated. Our two boys really enjoyed the area, running along the beach collecting stones and seashells. Phil Siemens visited us during our stay and we compared notes about life in Copenhagen.

At the Institute there are several impressions, which I still remember. One was observing how systematic Hans Bethe was in his work. On one side of the desk was a stack of blank A4 sheets of paper and on the other the completed sheets full of calculations. In the middle a small number of sheets he was working on. He was always friendly and open to a young aspiring scientist's stopping by to ask questions which were on my mind. His answers and explanations were clear and detailed and were much appreciated.

The many visitors to Nordita and the Niels Bohr Institute created a work environment, which allowed young scientists to grow and thrive. One example, which benefitted me, was the arrival of a delegation of scientists from China. The Niels Bohr Institute was hosting a delegation of Chinese nuclear physicists, among the first to leave China after the cultural revolution. I had the pleasure of working under the guidance of Gerry Brown. He took young Xu Zhan under his wings and we wrote a couple of papers together before Xu Zhan had to return early to take care of family matters. We also became good friends with several of the Chinese visitors. They were very good cooks and Alicia and I learned a lot about life in China during the cultural revolution. After we left Copenhagen we kept in touch with Xu Zhan and he visited us in South Carolina. Later Alicia paid him and his family a visit in Beijing.

Gerry Brown was the one who attracted me to Nordita. Working with Gerry was a pleasure and in the two years of the four when he did not stay long in Copenhagen he brought me to Stony Brook for a few weeks. This was the time of Gerry's 'little bag' project and the start of the chiral bag (cloudy bag) adventure, a project I worked on for many years. Largely due to Gerry's advice the whole family moved to South Carolina from Copenhagen.

The one comment, which stays firmly imprinted in my mind, was what Nils Robert Nilsson told me after I gave a seminar. During the seminar I argued that the repulsion between two nucleons was partly due to the quark content of the nucleons. He basically told me that my presentation was a really good tall tale.

Holger Bech Nielsen, Denmark, 1969-1971

Working on the Veneziano model

Half a year after I had after many years finished my cand. scient. examination - a half year during which I had had an instructorship - I was encouraged to remember to apply for a Nordita stipend. At that time the important professor in high energy physics - my field - was Jim Hamilton. While I was working with Ziro Koba on the rather recent and, at that time, very fashionable field of Veneziano models, Jim Hamilton worked on constructing scattering amplitudes from analyticity properties, so it was felt to be a slightly different branch. But I actually remember that I listened to the study groups that he guided and I had been listening to his lectures before I even got my examination as cand. scient., and I continued to do so. I even became a coauthor on an article by Colin Froggatt and Jens Lyng Petersen



Holger Bech Nielsen and a conference participant. Behind one can see Kim Sneppen, Henning Heiselberg and Per Hedegaard,

on this subject. They had a partial wave analysis of π - π scattering. But mostly I worked with Ziro Koba on the Veneziano model, which is what one would refer to in modern terms as string theory. But at that time I was at first the only one around talking about the string although the Veneziano model theory was very popular around the world. Poul Olesen had been away but we worked on strings and very importantly I had correspondence with David Fairlie about strings.

It should also be mentioned that I was actually on leave of absence from Nordita for 9 months to go to CERN, where I had strong contact to the people involved with Veneziano models.

My stipendiate time at Nordita ended by my getting an, in effect, permanent position at the Niels Bohr Institute as amanuensis. I remember that I had a month employment lacking, but that Nordita was so kind as to give me an extra month.

But the end of my stipendiate period was not the end of my attachment to Nordita, because some years later I became a consultant to Nordita while I still had my position at the Niels Bohr Institute. I was, for instance, involved in phoning around Norden to select from the list of applicants the best ones to be hired as Nordita fellows.

Risto Nieminen, Finland, 1975-77

Happy Memories from Blegdamsvej

Forty years ago, on a sunny afternoon in August, I arrived in Copenhagen. I had just spent two years on a scholarship in Cavendish Laboratory, Cambridge and finished my doctorate at Helsinki University of Technology. I came by train from Namur, Belgium, where I had attended a summer school on surface physics. My wife and two-year old daughter joined me soon, and we moved to a wonderful townhouse apartment on Carstensgade, Vesterbro. From the beginning, we felt truly welcome and at home in Copenhagen. For me the next two years at Nordita were among the best in my life.

The condensed-matter physics activities at Nordita were buzzing. Alan Luther and John Hertz were joining the faculty, where Chris Pethick was already running a remarkable cross-disciplinary programme at Nordita and the Niels Bohr Institute, with interests ranging from liquid helium to nuclear matter and astrophysics. John Wilkins was a visiting professor from Cornell, and brought in a constant flux of visitors. He was instrumental in creating and fostering the culture of contacts and collaborations. There were frequent mutual visits and joint seminars with the Ørsted Institute across Fælledparken and with DTU in Lyngby. There were visits to and from Århus, Chalmers, Lund and Linköping. The contacts forged during those days have remained lively throughout my career.

Six Nordita stipendiates started in 1975: Greger Lindell and Åke Nordlund from Sweden, Ove Jepsen from Denmark, Martti Salomaa, Lauri Lantto and myself from Finland. Four of us stayed in academia. Åke in Denmark, and Ove in Germany. Martti, who tragically passed away in 2004, was a colleague in Helsinki. Lauri became a lifelong friend, who has made a distinguished career in administration.

We were exposed to an incredibly rich scientific environment at Blegdamsvej, which was a natural and much-used stopover for visitors around the world. In condensed-matter physics, several exciting developments were taking place, such as the exotic properties of the newly discovered superfluid phases of ^3He , the breakthroughs in the renormalization-group approach to critical phenomena, and the exploration of low-dimensional quantum systems. Computational physics was emerging as a major activity, for example in solving many-body problems and in electronic-structure calculations. The revolution in surface science and its applications was well underway. Discussions with original and creative theorists such as René Monnier, Per Bak and Geoffrey Grinstein had a lasting impact.

Accurate calculations of condensed-matter properties from first principles, i.e., based on their electronic degrees of freedom, are nowadays a huge undertaking in computational physics and chemistry. This is enabled by the massive increase in computer power, but also by major conceptual and methodological advances in the underlying density-functional theory. It was fascinating to see the beginning of some of the key developments in Nordita in 1975-1977, when David Langreth and John Perdew worked on the development of gradient-corrected functionals, which later become famous as the GGAs, now used in thousands of calculations. Ole Krogh Andersen's group in Lyngby, Bengt Lundqvist and Jens Nørskov in Århus, Lars Hedin's group in Lund, Börje Johansson in Studsvik, Karl-Fredrik Berggren in Linköping and many others were among the early enthusiasts.

Nordita was a happy place to work in, with an open and friendly atmosphere, helpful staff, and lots of Danish *hygge*. Joint lunches with *smørrebrød* in the cafeteria, squash in Svanemøllehallen, Christmas parties and other occasional events have stayed in my memory. Among the special highlights was naturally the Nobel Prize in Physics 1975 awarded to Aage Bohr, Ben Mottelson and James Rainwater. The then Nordita director Professor Aage Bohr and his wife invited all the stipendiates to an unforgettable dinner at their house.

The two years at Nordita and later contacts to it eventually influenced my thinking and career significantly. Over the years, I came back many times, served on the various committees and the Nordita Board, and even was an interim director upon the move to Stockholm. But nothing beats the golden memories from Copenhagen in the mid-70s. In addition, our second daughter was born in Rigshospitalet in 1977, which is another strong link to Copenhagen, the most liveable city in the world.

Åke Nordlund, Sweden, 1975-1978

Memories from the Mid 1970s

When I came to Nordita in August 1975 I met Greger Lindell on the very first day. He had been a fellow student at Uppsala, but since his field was solid state physics we had lost contact for some years after Uppsala. His superior at Nordita was John Wilkins, and his group had a German visitor in December 1975. Greger and I were charged with entertaining this visitor and we took him to a well-known jazz bar, Vingården. There I danced with a very sweet girl whom I accompanied to the bus stop where we agreed to meet again on a specific day after Christmas. When the day arrived, the girl – I have later been told – was rather tired and not at all keen on going to Vingården again. But her Faroese friend in the student hall of residence, who was a musician at Vingården, managed to persuade her to go anyway. The rest is history, as they say. Inge-Lise and I have known each other for 41 years, we have three grown-up children and have been married for 31 years, since the tenth anniversary of December 17, 1975.

Another incident which I remember is when a police detective turned up at Nordita. In connection with my fellowship I lived in Copenhagen and had brought my old Mercedes Benz, which was equipped with Swedish number plates. The policemen had observed the car outside a mysterious house on Violvej in Gentofte. The house had a garage (which actually only contained a table tennis board), but no visible entry to that garage, since a hedge seemed to (and actually did) make it impossible to get a car into the garage. This seemed suspicious to the policemen, who reported their observations to their superior, who via the number plates was able to identify the owner as a Swede who was currently a fellow at Nordita. The police officer paid a visit to Nordita and spoke to me and Helle, but we were able to convince him that no illegal activities were involved.

One memorable incident remains: Nordita (i.e., Helle) received a bill from a porn shop and duly paid it. The reason was that I had used an 8 millimeter camera to make animations from a computer screen and I needed to get the film developed quickly because I was on my way to a conference. I found a shop on Amager which promised swift and cheap delivery, and it was only when I delivered the film (on bicycle) that I discovered what kind of shop it was. However, it was too late to find another place, and in the end the job was done.

Per Osland, Norway, 1976 and 1978-1980

Two Stays at Nordita

I was at Nordita for two periods. The first period was winter, spring and summer of 1976. I came from ICTP in Trieste, lived in Strandvejen, and enjoyed very much the sweet draft coming from the nearby Tuborg brewery when the wind came from the East. During this period I mostly worked with Göran Fäldt, who was then in Stockholm.

The second period was a two-year-plus period, from October 1978 until the end of 1980. We came from the US with a 6-month old baby. It was a bit of a cultural shock, coming from Harvard. Instead of having bookstores and libraries on every corner, our nearest ‘cultural’ establishment was a Danseinstitut. We initially missed Pampers diapers, but adapted to the Irma version.

During this period, DESY had started producing interesting results on electron-positron collisions, culminating with the discovery of the gluon in 1979. I was working with Paul Hoyer, as well as with colleagues at DESY and in Trondheim.

In those days, Chinese postdocs had started coming to the Niels Bohr Institute. I shared an office with Yong-Shou Chen. One evening, he invited us for dinner in the private house where he was staying. He had prepared all kinds of fancy dishes, and in the middle of the table there was a bottle of gin. “Somebody told me gin is a good wine”, he said. I felt obliged to offer some information which might perhaps be useful. So I said something like this: “Gin is not really a wine. It is very strong”. His reply came without hesitation: “We use strong wines in China!”

Ellen Kjeldtoft Pedersen, secretary 1980-2006

A quarter of a century as a secretary at Nordita

I worked as a secretary for the solid state physics group, which included bio and chaos, and took part in the administrative tasks. I shall here just give a few examples from my memory. Nordita had many visiting scientists for shorter or longer periods. With some of these one developed a personal relationship. I remember among others Dr. Alexander Nersesyan from Tbilisi, who for several years paid longer visits to the institute. He brought along the excellent brandy from Azerbaijan. When I made a longer trip to the Eastern countries I visited his very kind wife.

Among the fellows I noticed the ‘silent’ Finns. Most of them started talking after some time. Some fellows sitting at the top of the Nordita building, the so-called horse stable, used the electric water kettle to warm up sausages.

Something which I remember very well is the many meetings and symposia. The work in connection with the planning and holding of the bigger meetings took time and unexpected problems always came up. Hotel rooms should be reserved, if possible, a year ahead. We especially used the hotels Continent at Nørrebrogade, Østerport, 9 Små Hjem and Hotel City. The participants were placed at the different hotels in cooperation with the physicist in charge of the meeting. It was popular to hold summer schools; all participants were at a course resort with board and lodging during the session. For several years we held a course almost every summer at Krogerup Højskole in Humlebæk. This place was very popular, despite the fact that there were no rooms with private bath and toilet. The participants had free entrance to the Louisiana Museum nearby. The cooperation with the headmaster at that time, Søren Bald, was excellent. I was allowed to use his office during the course.

I was also secretary at a couple of meetings in Sweden, among others the Gothenburg, Nordita/Landau Workshop on Condensed Matter Physics, 14.6-17.7.1981(organized by Chalmers and Nordita in collaboration with the Landau Institute). First there was a week of concentrated research reports at the course resort Aspenäsgården; thereafter several weeks of seminars at Chalmers, Gothenburg. Aspenäsgården was a very beautiful property placed in a park with a little lake and boat. After dinner we spent the long summer nights with ‘hygge’ and talk. One of the ‘very charming’ American researchers next morning returned a pretty night dress which he had found in his room. The stay at Chalmers took place after midsummer, and members

of our group were, except for a few Swedish researchers, the only ones at the physics department. The social part of the meeting consisted of a daily football match between the Americans and Russians (we had twelve of each) and maybe a visit to the Liseberg amusement park, or a walk down the main street, where the young Swedes cruised up and down in their big American cars. There were 27 Nordic participants and 46 participants from elsewhere.

A real tour de force in connection with the holding of conferences was to settle the travel expenses and per diem to the participants during the meeting. At first the travel forms filled in by the participants were to be collected, thereafter typing out the statement (four copies: bookkeeper, archive, participant and annual report), count the amount and place it in an envelope, then the hunt to find the participant and get a signature. This way we escaped the slow and expensive transfers via the bank. We collected the large amount of money in the bank at Trianglen, DKK 30,000 at a time, often several times a day. For many years it was the 'blue men' of the institute who, in connection with the delivery of the outgoing mail at the post office, also went to the bank. Later it was not allowed to use the 'blue men' for this purpose since it was too dangerous, so we went ourselves. Before this we had asked the bank to count the money in advance so that nobody in the queue could see the big amount. The cash was counted every day and failures were rare. This kind of reimbursement might not be possible today, but it was very efficient.

In connection with the meetings a welcome reception with a buffet was often arranged and on one of the last days a conference dinner. At one of the bigger events in Copenhagen the delivery of a buffet at Glyptoteket was arranged with a company. The buffet was mostly roasted chicken drumsticks. Unfortunately it turned out that the chickens were so small and so few that most participants ate two to four each and many did not get anything. This was added to the conference manual: always when ordering food draw attention to the fact that the brainwork of physicists demands many calories and researchers rarely get enough by eating canapés.

A propos dinners, it was a big event to be invited, together with all employees at the Niels Bohr Institute, to a dinner in the Freemasons' building next to the institute in connection with the 100 years jubilee of the birth of Niels Bohr (1985). Normally a closed country for women, this later in the evening became a bit of a problem as there were no toilets marked 'women'. In connection with the Nordita Board meetings a buffet dinner was arranged for the employees and the Board. There were speeches for new and old and later there was often singing. Especially Alpo Kallio, Finland, Jan Vaagen, Norway, Leo Nielsen, Denmark, Nils Robert Nilsson and others sang nicely in chorus.

Jens Lyng Petersen, Danmark, 1967-1969 and assistant professor 1972-1975

High Energy Physics on Blegdamsvej in the 1960s and 70s

First a brief account of the situation in Copenhagen at Nordita and the Niels Bohr Institute around 1964. The NBI was a regular University Institute with teaching and research whereas Nordita was a Scandinavian research institute. Research at the two institutes was carried out in close collaboration and harmony, and was dominated almost entirely by nuclear physics. At Nordita the research was by definition entirely of a theoretical nature, whereas at the NBI there was both theory and experiment.

In high energy physics there was not so much. Denmark had joined CERN as a member country and a relatively small group of experimenters worked in collaborations there. Both at the NBI and at Nordita it was decided at the beginning of the sixties to strengthen high energy physics and look for professors within this field. The NBI hired Ziro Koba, from Japan, and Nordita James Hamilton, from the UK.

I should perhaps explain that the scientific climate in Copenhagen then like today was marked by a great many visitors who came practically every week to present seminars in the famous Auditorium A, religiously kept with the same décor as when the founding fathers of quantum mechanics sat there in the 1920s and 1930s. In the front row Aage Bohr and Ben Mottelson would take residence at the centre and play leading roles in the discussions. Also Hamilton would take a place in the front row and ask questions as well but of a less penetrating nature. Koba on the contrary would sit in the back and only occasionally take part in discussions.

When Hamilton arrived in 1964 he immediately started giving lectures on elementary particle physics. I followed these very carefully and in the problem sessions I was one of the best prepared students. Hamilton soon noticed me and took pleasure in my work. Later I approached both Koba and Hamilton for advice on a subject for my upcoming master thesis and I opted in favor of the subject proposed by Jim. Of course, as a professor at Nordita, he had no obligation to guide a student from the university, but it was customary for Nordita professors to occasionally do so. About a year later, early in 1967, I handed in my written thesis and finished my exams for my final so-called cand. scient. degree.

After some months I managed to get a two year grant for young researchers at the university. Again I approached Hamilton and asked him for a problem to work on, and he explained to me a problem he wanted to clarify. Later a Swedish Nordita fellow Gösta Gustafson joined the group of

Hamilton. When my two year contract with the university was about to end I was encouraged to apply for a Nordita fellowship. I was successful and this brought me closer to Hamilton.

During the next several years, a number of current or past Nordita fellows joined the group, Henry Nielsen, Finn Elvekjær, Esko Pietarinen and Bjarne Tromborg, as well as Geoff Oades, a former student of Hamilton who had obtained tenure at Aarhus University. During the various meetings we had, there were many occasions to have social contacts of a very enjoyable nature be it in Copenhagen, in Lund, or in Aarhus. Hamilton would always be a very friendly companion on such occasions.

After my two years at Nordita I obtained a new three year contract with the University of Copenhagen, one that allowed me to travel abroad, and I decided to apply to CERN with a view to spending two years there. All in all the years from 1967 to 1970 were extremely happy ones for me. I matured as a young researcher and I thrived under the friendly support from Hamilton. I made lifetime friendships with young people and felt very comfortable with Hamilton also at a human level.

In 1969 the field of high energy physics was marked by the advent of the so-called Veneziano model. I was interested in this new development but Hamilton was not. He, like many other physicists at that time, considered this whole field to be of dubious value. The leading thinking at the time, which both Hamilton and I followed, was that the strong interactions had to be understood on the basis of S-matrix and dispersion theory. But a growing number of people began to doubt this was the right approach.. In the next several years this field of dual resonance models attracted enormous attention and Holger Bech Nielsen¹ at the NBI became one of the leading figures.

From September 1970 to August 1972 I worked at the CERN theory division, partly supported by CERN, partly by a three year Danish University contract which I obtained when my time as a Nordita fellow expired. Hamilton saw to it that, after my three year contract at the university expired, I received a three year contract at Nordita as assistant professor, he even persuaded the Board to extend the original three year offer to a five year contract starting 1972. After my return from CERN I learned to my grief that the atmosphere between the high energy groups at NBI and Nordita had become very difficult.

Other things went rather well. Hamilton had conceived a scheme whereby Nordita would finance regular meetings to bring together people from around

¹Holger Bech Nielsen received a Nordita fellowship (1969-71) and was later associated with Nordita as consultant in high energy physics 1.1.80-30.6.85. In May 1985 Holger Bech Nielsen was appointed to a professorship at the Niels Bohr Institute

the Nordic countries on a regular basis about 4 times a year, to discuss various aspects of common interest and to form a coherent research effort on related subjects. This was in a way an expansion of the small group started in the late 1960s. G.Oades and other senior members often brought students to the meetings and other fellows were invited to participate. Later, visitors from abroad were invited to the meetings. This scheme of his was a relatively original contribution to a way in which Nordita could operate efficiently in a research mode, and it was later copied in various forms by others.

In late 1974 an announcement was made for an opening for an assistant professorship (lektorat) in high energy physics at the NBI, just my favorite position. I had applied in vain before. This time I succeeded and took up my position at the NBI in July 1975. I had told Hamilton I wanted to continue our cooperation as an active member of his group, including the arrangement of meetings.

During the first half of the 1970s the breakthrough of the Standard Model took form. I was personally very slow to realize this and I was skeptical towards the concept of quarks. But after the establishment of the existence of the charm quark in 1974-1975 I realized it was high time to follow the tide. I decided to change my direction of research and as a result probably leave the Hamilton group unless the group adopted my point of view. Of course, at that time most of the NBI high energy people had made the transition. I met with Hamilton to explain my views. As I suspected he did not agree to altering the research direction of the group and I resigned as a group member. Hamilton wanted to continue research on the basis of S-matrix and dispersion theory. I had anticipated that the group would carry on without me, but after a short while it ceased to exist.

In 1974 Nordita hired two assistant professors, the Norwegian Finn Ravndal, who in 1976 became professor at Oslo University, and the Italian Paolo Di Vecchia. Both about my age, very active in research and enthusiastically embracing the new physics. After Finn Ravndal left, Paul Hoyer, from Finland, became a member of the high energy group. Thereby the collaboration between the high energy theory groups of Nordita and the NBI once again was reestablished in full force.

Carsten Peterson, Sweden, 1978-80 and 1982

From High Energy Physics to Biophysics

I came to Nordita as a fellow, my first postdoc, after my PhD in Lund in 1977 within theoretical high energy physics. I continued to live in Lund and commuted daily on the hydrofoil together with Petter Minnhagen and Claes Fransson (both also at Nordita) - a very stimulating and pleasant company. The winters of 1978-79 and 1979-1980 were quite cold with the Øresund sometimes frozen making our journeys quite exciting.

Starting at Nordita with its variety of theoretical physics fields represented under one roof and the stimulating seminar program opened a new world. I filled in gaps in my quantum field theory knowledge as well as in solid state physics. I swiftly got involved in several collaborations with other fellows (Paul Hoyer and Hans Hansson) as well as visitors (Stan Brodsky and Tom Walsh). The Brodsky collaboration resulted in publications still cited on a weekly basis and also in a postdoc at Stanford Linear Accelerator (SLAC) to follow my Nordita years. I shared an office with Predrag Cvitanović, which further widened my scientific horizon.

In 1982 my fellowship got extended for a third year after my two years at SLAC. On coming back I changed research field to that of lattice gauge theories, collaborating with Jan Ambjørn and Poul Olesen (NBI) with a series of interesting publications coming out during a very short period. Its statistical mechanics and Monte Carlo simulation flavor determined my subsequent path into associative memories, difficult optimization problems, machine learning and finally biological physics after returning to a faculty position in Lund. In short, it was an agenda-setting period for my future.

The atmosphere at Nordita was characterized by scientific curiosity in an open and relaxed environment, which is sometimes hard to find. The administrative staff was efficient with ample social skills making my stay enjoyable.

My ties with Nordita/NBI have continued ever since with ample scientific contacts and participation in steering groups and evaluation committees at different levels. Those include Benny Lautrup on machine learning and Kim Sneppen and Mogens Jensen on biophysics. I still feel at home on Blegdamsvej!

Jørgen Randrup, Denmark, 1976-79

Nordita and Me

The very first time I set foot at Nordita was in the Spring of 1972. I was then a student at the University of Aarhus and I was working towards completing my PhD as fast as possible, so that I could utilize the remaining portion of my fellowship for going abroad. The big question was where to go, and I decided to consult with Ben Mottelson who surely would know more about this than anyone in Aarhus at the time. Ben kindly consented to see me and, on the appointed morning, I showed up at the Nordita “reception” where I was greeted in a very friendly manner by a woman who looked young but very much in charge, Helle Kiilerich. I must admit that I was somewhat surprised that she was actually expecting me - but I have learned later on that there is not much going on at Nordita that Helle is not fully aware of. Ben made a big impression on me, especially his inexhaustible enthusiasm, and when I described to him what I was working on, he said that it sounded ‘very interesting’. That was actually the most encouraging comment I had ever received on my research and it got me so fired up that I spent the entire time on the return trip that evening writing up a draft that turned into my very first single-author paper.

That first visit was on a Wednesday, so I was able to attend the weekly seminar in the creaky Auditorium A which was also an experience. There was a lot more ‘audience participation’ (read: agitated shouting) than I was used to from Jutland, and I noticed especially a couple of young guys who were particularly outspoken in their comments. They turned out to be Aksel Jensen and Thomas Døssing, and I have kept good contact with them throughout the years. Indeed, I have worked closely with Thomas occasionally and we have recently started collaborating again.

Following Ben’s advice, I took off for Berkeley that September and I ended up spending three great post-doctoral years there. During my last summer there, in 1975, Aage Bohr was visiting us for several weeks and he kindly encouraged me to come to Copenhagen after I was done in Berkeley. So I showed up there in early November. Aage told me then that the plan had been for me to take over a Nordita Fellowship but, contrary to expectation, it had not been vacated that autumn after all. So a Carlsberg Fellowship was hastily arranged for me to tie me over until, in due course, I became a genuine Nordita Fellow, first a regular fellow and then advancing to Senior Fellow. Thus I spent about three and a half years on Blegdamsvej and those

years were probably the most intense and productive of my entire research career.

Nordita offered a wonderful environment especially for young people getting started, because the atmosphere was generally very supportive, not only with verbal encouragement but also with funds for travel and visitors - I was never turned down when requesting a trip or wanting to invite a guest, and I wish that my working conditions could have remained that ideal later on. There was also a minimum of bureaucratic formalities to deal with, thanks in large part to the efficiency of Helle which somehow permeated the entire operation. Furthermore, the unique environment in which Nordita was embedded offered enviable opportunities for making contact with outstanding people from around the world, whether other youngsters or established leaders.

Aage was Nordita Director at the time and he was very keen on fostering better interaction between the various fields being pursued. One initiative consisted of monthly morning gatherings for faculty and fellows (with pastry and coffee) during which selected people would tell about their work. Another initiative (during the autumn of 1978, I believe) was a lecture series in which an expert from one of the fields would give several lectures directed at those from outside his field; the lecturer would then, together with two non-expert 'editors', prepare notes, the idea being that the involvement of the non-expert fellows would help to translate incomprehensible jargon and generally improve the utility of the notes. One of the lecturers was Holger Bech Nielsen and I was one of his editors. It was very hard work to transform Holger's entertaining and vivid performances into coherent and comprehensible prose (and it didn't make matters any easier that he wrote his manuscript on transparencies, giving poor Eva a very hard time typing it up), but we all worked tirelessly on it evening after evening and it was gratifying that the resulting Nordita preprint was very well received - in fact it became so popular that it had to be reprinted not only once but twice to satisfy the worldwide demand. For me, this effort had the benefit of teaching me the essentials about "QCD, Asymptotic Freedom, and the Bag Model".

During my time at Nordita, it was decided that also the fellows and (I believe) the non-scientific staff should be represented on the Board. The fellows elected me as their board member, a responsibility I took pride in, and the couple of board meetings I attended were very interesting and educational for me. I was gratified that certain issues I had raised on behalf of the fellows were given serious attention and eventually resolved in a satisfactory manner.

By 1978, I was on the fifth year after my PhD and I felt the need for trying to secure a suitable career position. This was not an easy task as

there were few openings and many highly qualified young people. That was especially true in Denmark – Aage Bohr told me that he did not expect a single opening for the next ten years, a prediction that turned out to be accurate. So it was either high school in Denmark (a career to which I was not opposed but I did not feel quite ready to throw in the towel on my research yet) or a job abroad (of which there were hardly any). But it so happened that a position was just then opening up back in Berkeley and I was fortunate enough to be appointed. During my time at Nordita, I had come to really like not only the environment at the institute but also my personal life in Copenhagen, so it was with a somewhat heavy heart that I again left Denmark, this time perhaps for good. But fortunately, though, I knew Berkeley already (and had good friends there) so I felt certain that I would thrive there as well - and indeed I have.

Over the many years since my time as Nordita fellow, I have returned to the institute numerous times and it has always been great. I had the particular pleasure of visiting for a full year in the mid eighties and about half a year at the turn of the millenium. For many years, whenever my travels would present the opportunity, I would try to stop by, and those brief visits were always very worthwhile and stimulating. However, regrettable but natural, ever fewer remain of those individuals with whom I have had the most contact – and even Nordita itself has now moved its main base away. Consequently, thinking about how my relationship with the institute has evolved throughout my career, it feels like things have now come full circle, because the Nordita-related people I am most likely to encounter there nowadays are the very same ones who welcomed me so warmly during my first visit, namely Helle and Ben.

Finn Ravndal, Norway, 1974-1976

The Early Days of Quarks

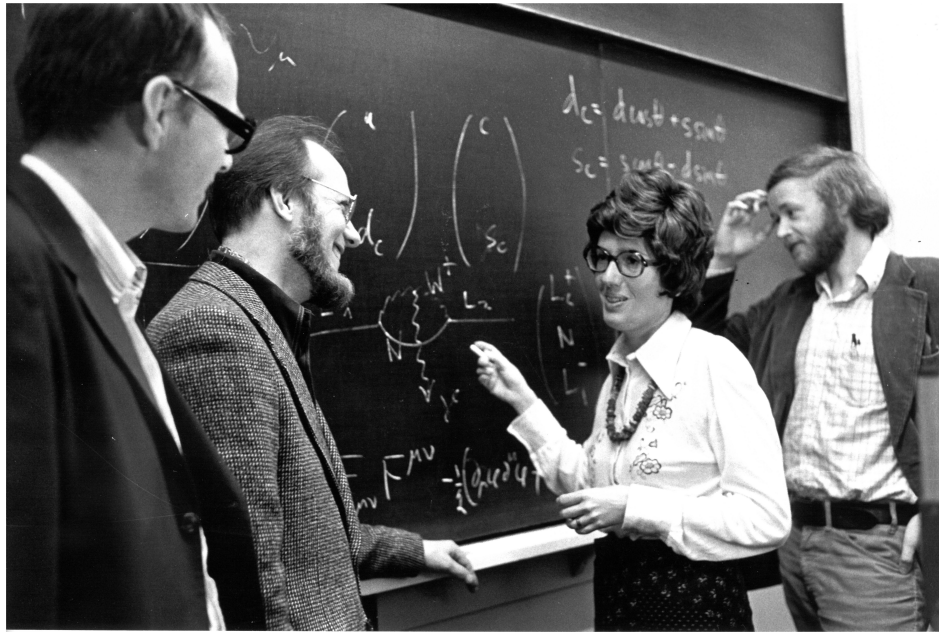
Already as a student at NTH in Norway I had heard a lot about the Nordic institute in Copenhagen from my advisor Harald Wergeland, one of the founding fathers. So in 1967 when I was told about the SINBI summer school in high energy physics at the Bohr Institute the same year, I applied and was accepted. That was my first meeting with the ‘Copenhagen spirit’ which has been so much praised by physicists from all parts of the world. And it also turned out to be important for the direction my life would soon take.

Together with two students from Aarhus I was housed in the basement of a house in Hellerup. It was here I learned to spend Sunday mornings buying fresh newspapers (which we at that time didn’t have in Norway) and wienerbrød from the local baker instead of having to climb mountains or trudge through the local forests which I was accustomed to do on that day of the week. That was a real eyeopener! This was in contrast to the lectures at the institute which mostly went far above my head. Two years earlier I had spent the summer at CERN working in an experimental group where I ended up being the local expert on the quark model and how to use it to explain the new particles which the group explored. But that kind of physics didn’t seem to be present at the summer school. Instead I was for the first time exposed to the Adler–Weisberger relation which was then brand new. Although I couldn’t follow the details of the derivation, I found the result very attractive. Finally a result for strong interactions which seemed to be exactly right! And this was based on the current algebra derived by Murray Gell-Mann based on his idea of having quarks inside the strongly interacting particles. But how could this AW-relation be so accurate while the quark model itself only seemed to be a crude approximation? It would take a few more years before that question was answered.

Back in Norway I went directly into the military, spending one year at FFI working on the effects of atomic weapons. There was also Per Osland who played with the idea of going to the US to get a doctors degree there. After all the inspiration in Copenhagen, I wanted to continue learning more about quarks and symmetries, but was no longer convinced that I could do that essentially alone in Trondheim. So thanks to Per I applied to several American universities and was in 1968 accepted as a graduate student at Caltech in Pasadena - the birthplace of quarks! In 1971 I got my PhD there after having written a thesis on a covariant formulation of the quark model

in close collaboration with Richard Feynman. He wanted me to stay on there two more years as a postdoc to extend this work. During this time I was offered a permanent job at my old university in Norway and planned to go back there in 1973. But to my surprise Feynman didn't want me to leave and go back. Instead he talked warmly about Copenhagen where he went in 1972 to receive the Ørsted Medal. The net result was that I could spend the summer of 1973 at Nordita and then return to Pasadena. Nothing better!

At Nordita I was received like a king, placed in one of the best and biggest offices where I felt a little isolated after all the excitement at Caltech. Asymptotic freedom was just discovered and we could see a new, fundamental theory for strong interactions taking form. It was then called QHD for Quantum Hadrodynamics and became shortly thereafter known as QCD where the C now stood for the colors of the quarks. But in Copenhagen it was all quiet and I soon found out that everyone was off on summer vacation. That was probably also the reason for receiving a ton with Danish kroner in cash on one of the first days there, brought onto my desk by one of these marvellous Nordita secretaries, Inge Søndergaard. I had never before (or since) felt so rich!



Bengt E. Y. Svensson, Matts Roos, Cecilia Jarlskog and Finn Ravndal at the blackboard in Aud. A (1976).

The same summer Norsk Fysisk Selskap held its yearly meeting in Trondheim and I was invited to talk about the recent discoveries of scaling in deep

inelastic electron scattering and their explanation in terms of quarks and partons. I felt a certain skepticism towards these new ideas and had decided to say nothing about colors and asymptotic freedom. After I had finished there were no questions so that the chairman of the session, Torbjørn Sikkeland, came up with the million-dollar-question – why the hit quarks didn't show up as free particles. Then I had to come up with the usual story about attractive color forces etc which seemed to make everyone even more skeptical. In the following coffee break Wergeland came over to compliment me for 'a very interesting talk'. But the main point was that I shouldn't at the end have said 'anything so ridiculous that the quarks were colored'!

In the fall I returned to Caltech with my plans for a future in Trondheim essentially in the waste basket. I was open for any other possibility and very soon this showed up in form of a new 6-year long, assistant professor position at Nordita. Early in the spring I was informed that I was hired together with Paolo Di Vecchia. He was working more in the direction of dual string models which already was a strong activity at the NBI. Together with my own more phenomenological interests these two appointments were meant to bring the different particle physics interests at the institutes on Blegdamsvej more together. I soon realized that that would not be so easy. But nothing can beat experiments!

Before settling down in Copenhagen in the fall 1974, I had been at the international HEP conference in London. What for me was most memorable, were the new measurements of the electron-positron annihilation cross section which at large energies seemed to show that the quark idea was wrong. In the subsequent discussion session John Ellis could present ten different explanations, none of which involved a charmed quark. This was in sharp contrast to John Iliopoulos who in a concluding talk presented a bet that it would be found before the next meeting. And he won the bet! The news of the discovery of the J/ψ -particle reached also us in Copenhagen like a bombshell in the fall. Everyone was so excited and all kinds of explanations were debated. I had almost grown up with quarks and could hardly think outside that box. Luckily the new particle turned out to be a bound charmed quark and its antiquark and the phenomenological excitement shifted soon over into a more theoretical gear.

Like in other places at that time, there was still a certain skepticism towards quarks also in Copenhagen. Those who took an active interest, wanted to understand the theoretical underpinnings better rather than explore the experimental consequences of the new QCD theory. One exception was Andrzej Buras who was a postdoc at NBI at that time working on scaling in hadronic collisions. He was ambitious and hard working and I discovered him several times at his desk late in the evenings where he was reading up

on the quark literature after having finished his normal work during the day. He later made a very successful career in the quark field.

Among the professors was Gerry Brown who showed the most interest for quarks and right away thought about their relevance for low-energy nuclear physics. He had been invited to a Spaatind meeting to talk about his own research, but asked me to go instead and say something about QCD and nuclear forces. It turned out that few in nuclear community had the same enthusiasm for these new ideas as Gerry had. Besides him, almost every time I met Knud Hansen he wanted to hear about the latest developments in this field and convinced me to give a talk for a group of younger students. At the institute Christmas party at the end of 1974, which took place in the old 'frokoststue' where the small cafeteria was, I remember well that I got to see Margrethe Bohr for the first and only time. That made a deep impression upon me. With the elated atmosphere there it felt being in a magical place. I guess I was touched by the Copenhagen spirit.

The winter-spring term 1975 I spent at the Rutherford Laboratories outside Oxford. A quite different place where we spent very much time drinking tea. I don't know how decisive that was when the group I belonged to, some years later was terminated. For me it was a quiet and pleasant time which I used to dig into more theoretical work having to do with the underpinnings of scaling and the use of the renormalization group. When seen in the light of statistical mechanics it opened up great perspectives.

Back at Nordita I decided to give a lecture series on all this starting in the fall of 1975. One who encouraged me very much, was Aage Bohr who also was present at many of the lectures. These I wrote up in the same series of Nordita lecture notes I had learned so much from as a student. They were surprisingly well received and I was approached by two publishers who wanted to make them into a book. That would have required much more work and I was not prepared for that. During this time I had also received an offer of a professorship in Bergen and then one from Oslo. I decided to go to Oslo and left Copenhagen in the summer 1976, after only two years at Nordita.

In the following years I was lucky to remain in contact with my colleagues (and Helle Kiilerich!) in Copenhagen, especially after 1979 when I joined the Board as a Norwegian member. One of the main issues became the reduction of the top-heavy ruling structure with a Forretningsudvalg and a more parliamentary Styrelse with less influence and insight. After some hefty discussions the end result was the elimination of the former and replacing it with a smaller and more active Board. Getting to know the other members gave me great pleasure. Magnus Magnusson from Iceland made such a fascinating impression that my oldest son carries his name! My daughter has also a name that I learned to love during my time in Copenhagen.

Dan-Olof Riska, Finland, 1969-1971

Nordita 1969-1971

In the fall of 1969 I arrived at the Nordic Institute of Theoretical Physics Nordita, as a stipendiate. Nordita was at that time associated with the Niels Bohr Institute (NBI) in Copenhagen. I was assigned an office shared with John Negele. John had obtained his PhD at Cornell with Hans Bethe in the spring of that year, and was beginning his first postdoctoral year at the NBI. The other roommate was Jouko Arponen, who had graduated from the Helsinki University of Technology a few years before me, and who worked on a thesis in many-body theory. I spent the first month writing up my licentiate thesis on a topic in quantum optics, while I was looking around for something to do.

I was recently married, and luckily my wife Elianne had obtained a Danish state scholarship that supported graduate studies at Danish universities by Finnish students. Thus while I worked at Nordita she studied sociology at the University of Copenhagen.

The NBI at that time stood at the height of its reputation. It appeared that no new result in nuclear physics could be viewed as established until it had been presented in a seminar before the faculty of the NBI. To the most prominent senior NBI faculty members then belonged Aage Bohr, Gerry Brown, James Hamilton and Ben Mottelson. In the spring of 1970 the faculty was augmented by Hans Bethe, Gordon Baym, David Pines and Malvin Ruderman, who converged at the NBI to set up a framework for a solid theoretical description of neutron stars.

I knew about this forthcoming activity, and had even written to Gordon Baym prior to moving to Nordita, but received no answer. Then in October 1969 Gerry Brown returned from the US, so one day I asked him in the corridor if he might suggest some useful topic for me to work on. At that time Gerry was interested in mesonic effects in nuclei and was gearing up to a major attempt to derive a realistic form for the nucleon-nucleon interaction from meson exchange mechanisms. As warmups for joining this effort he assigned me problems related to meson exchange currents in few-nucleon systems and heavy nuclei. Solving those problems called for considerable effort on my part, as I had but little background in nuclear and particle physics, but fortunately drawing on the NBI library, I somehow managed. At least Gerry apparently thought so, because later in the fall of 1969 he told me to apply for a US immigration visa, as he would be able to arrange a

visiting faculty position for me at the State University of New York at Stony Brook, once my Nordita stipend would run out in August 1971.

This proved to be a lucky break, because at the NBI there was then a very large contingent of first year postdocs from many parts of the world, who were all quite anxious about their future career prospects in research, as at that time the large expansion of the university physics departments in the western world in the 1960s had more or less come to completion. Many of these postdocs spent most of their time typing and sending off ever more desperate application letters all over. John Negele in contrast appeared calm, however, apparently convinced that concentrating on his research and getting his thesis work published would in the end lead to a better result than spending a lot of time typing application letters. In this he was to be vindicated, as one day in the spring of 1970 the phone nearest our office in the hallway outside rang and someone called for John. The caller was Herman Feshbach, who offered John a faculty position at MIT. Thus John came to begin his long and successful career at MIT. Given this beginning of his MIT career, I feel that it was wonderful that John many years later became the first recipient of the Herman Feshbach prize in theoretical nuclear physics.

The daily work routine at Nordita in my case included attending the lectures of Gerry Brown, who insisted on attendance at his lectures on many body theory, and those of James Hamilton, who lectured on pion nucleon scattering (in fact Gerry, when at Nordita, also sat in at Hamilton's lectures). To that came the weekly seminars at NBI, where a considerable number of well known physicists gave presentations. The latter were tough for me, as most of the audience smoked during the seminars, and the smoke in the room was thick. For me the consequence were headaches and a lasting hatred of indoor smoking.

The main social life at Nordita were the endless luncheon discussions at the NBI cafeteria, which at that time only served traditional Danish open face sandwiches. A memorable event was the semicentennial of the NBI in 1971, which drew a lot of scientific celebrities and culminated in a grand party in the main building of the University of Copenhagen. There was also a number of fun and noisy dinner parties – mostly with the Nordic fellow stipendiates –, which led to very helpful Nordic networks in the long run.

We lived in a small apartment at Upsalagade, rented with the assistance of the NBI secretary, who handled visitor housing. The apartment was modest (to put it mildly), but conveniently located between the beautiful Østre Anlæg park and the Sortedam Lake, within walking distance from both Nordita and the city center. In my case adaptation to life in Copenhagen was easy as I spoke Danish, thanks to my Danish grandmother. Her father Sophus Müller had been director of the Danish National Museum,

and her siblings lived in the greater Copenhagen area and were helpful and hospitable. We also repeatedly enjoyed the hospitality of Erik and Lisbeth Siesby, who were friends of my parents, and who lived in a grand Arne Jacobsen designed villa in Virum. Erik was a professor in the Faculty of Law of the University of Copenhagen. During weekends with clement weather we made excursions all over Sjælland, as I was interested both in the Danish cultural history and nature. During the second year our explorations also included southern Sweden. As the Nordita stipend was modest in size, and I had to pay off my Finnish student loan, the delights of Copenhagen nightlife remained beyond our reach. Of the latter I knew as little when we left, as when we arrived.

In July 1971 I completed my two-year stipend at Nordita, and as planned moved on to Stony Brook. This was a major change of phase, if not a cultural shock, not the least because I there immediately had to start teaching a regular faculty course load, in addition to doing research. As the Stony Brook University at that time was undergoing a massive construction phase and administratively was still fairly chaotic, I certainly missed the smooth and helpful administration at Nordita a lot.

Matts Roos, Finland, 1962-1964

Nordita in the Sixties: the Life and Way of Life of the Nordita Fellows

Nordita fellowships were meant for doctoral students, but six influential docents and professors grabbed the Finnish fellowships the first years (1957-1960): Y. Ahmavaara, K. Laurikainen, P. Kustanheimo, O. Hellman, Y. Kilpi and B. Quist. The very first real doctoral students were K. Kurki-Suonio, N. Mustelin, A. Kallio, E. Byckling and myself.

Newly arrived fellows were called to a meeting with the professors, who questioned them about what physics problem they had in mind. Most of the fellows had no clear research plans and they were immediately recruited into the dynamic G. E. Brown's group. Potential physicists in elementary particle physics received no supervising, but fortunately also visiting professors other than nuclear scientists visited the Niels Bohr institute. We persuaded Z. Koba to lecture on particle physics and S.L. Glashow started a Danish-Finnish research group in weak interactions with the Nordita fellows Brene, Cronström, Hellesen, Roos and Veje. At the same time J.D. Bjorken and S. Gasiorowicz were at NBI, of good use and stimulation.

The most important event during the day was the lunch and maybe a seminar. For lunch one crossed Blegdamsvej and bought open sandwiches with liver paste, mushrooms and cucumber, mackerel salad, or peeled shrimps. In the lunchroom one could have coffee, tea and Danish pastry. An American couple had only pastry for lunch for a year and developed gastric ulcers. In the lunchroom, places at the tables were democratically mixed and the conversations was first of all about theoretical physics. Once a polite Japanese sat at my table presenting himself as Hideki Yukawa. Ben Mottelson often arrived at lunch time, and was pestered by the diligent Gerry Brown's provoking question, "Professor Mottelson, what have you achieved this morning?".

Once a year the fellows and their spouses as well as the professors were invited for dinner at Christian Møller's home. Here Møller taught us the noble art of smoking a cigar and told us it was seen as unsolidaric to drink Tuborg beer, as the NBI was supported by the Carlsberg Foundation. Niels Bohr himself lived in the luxury house of the foundation, and the entrance gate was decorated by the two elephants known from the label on Carlsberg Elephant beer.

Researchers at Nordita and NBI were mixed so that no one shared a room with a fellow countryman. Personally I had first an Austrian and,

the second year, the first communist-Chinese – only a Finn was seen to be neutral enough for this politically touchy job.

The impressive library was run by Stefan Rozental, who found he was entitled to read all periodicals and journals before they were placed in the reading room. Typically *Phys. Rev.* could be delayed for months lying locked up in his office. When Rozental retired and the neat and efficient Helle came, the lock on his door was changed the same night!

The spare time activities included football in the Fælledpark and visits to a sports club with swimming pool and sauna. An ambitious trainer there wanted to make us waterpolo-players, but the Finns were mostly sitting in the sauna and the Norwegians joined us in this sensible sport, so we did not become polo players.

Part of the cultural activities was newspaper reading. I read *Berlingske Tidene* on Sundays delivered to the front door by the bakery together with newly baked rolls. The Norwegians could not read *Berlingske*, the Danish way of spelling caused them problems. Alpo Kallio, who lived in a cold garden house and had to set fire to deciduous wood that did not easily catch fire, was patriotic and subscribed to *Helsinki Sanomat*, since this supplied him with plentiful material for the fire.

During the seminars the professors sat in the first row and smoked cigars. If the seminar was poor the criticism was left to angry young men at the back row, in particular Poul Olesen, and the professors escaped without comments in a nontransparent cloud of cigar smoke.

For all fellows the greatest benefit of Nordita was the stimulating environment and the international contacts one obtained there. Nordita and NBI had a constant flow of Nobel laureates and coming Nobel laureates, something one could not experience in the homeland. The seminars were stimulating and led to common research projects and friendships, which one at that time could not evaluate, but something that in general affected ones research career. Nuclear physicists can surely relate to such effects even more than particle physicists.

As for myself, after two years at Nordita I was offered one more year at NBI and later a position as amanuensis (which I did not accept). During a visit at Nordita/NBI, the Director general of CERN, Léon van Hove invited me to CERN, a visit that lasted for 6 years and led to a staff membership. Thereafter I was offered an assistant professorship in Helsinki and later a personal professorship.

Anders Rosengren, Sweden, 1976-1979

The Nordita–NBI Football Game

Remembering my time at Nordita, many things come to my mind. One thing stands out. The football match between Nordita and NBI. We were told that this annual match was a very old tradition. We practised a few times before the match. We were not that many stipendiats and not all of them were interested in sports, but we managed to put together a team. If I remember correctly it consisted of among others myself, Martti Salomaa, Greger Lindell, Risto Nieminen, Ove Jepsen, Henry Nørgaard, Åke Nordlund, René Monnier, and a German (probably high-energy physicist) with first name Hartmut (He told me this was a popular name in the forties). Half an hour before the game was to start many spectators gathered to watch. The match was played in nearby Fælledparken. Among them were many senior staff, and among them Aage Bohr, who was very interested and talked to us about the importance of winning the game. Nordita expects every man to do his duty! Aage Bohr certainly knew something about football. Both his father Niels and his uncle Harald were football players in Akademisk Boldklub, Niels as a goal keeper. Harald even played on the Danish national team and won a silver medal in the 1908 Summer Olympics! The referee (I think it was Marijan Šunjić who later became rector of the University of Zagreb and thereafter Croatia's ambassador to the Holy See) blew his whistle and the game started. It was extremely intense. Everyone played for the honour of his institute and as if it were his last game on Earth. I was once in Idrætsparken together with Greger Lindell and Per Bak to watch Denmark-Sweden and despite that Per was body-searched by the guards and Greger was very close to be beaten up, the experience of that game cannot compare to that of Nordita-NBI! Unfortunately I think we lost the game.

The next day I could hardly make it to the institute. My whole body was aching . When I arrived I found Nordita almost empty. Almost everybody who had participated in the game was suffering from haemorrhages, muscle ruptures, or broken legs. I then heard that the situation was the same for NBI. It took a few weeks before research recovered! Maybe this was the reason the game was not held the next year!

Mikko Saarela, Finland, 1973-1975

Memories of the Early 1970s

I started to study theoretical physics at the University of Oulu in Finland 1966. One of the lecturers was professor Alpo Kallio. He was a former Nordita fellow and a member of the Nordita Board. That is how we had first-hand information about Nordita in Oulu. Nordita was a highly valued institute and students in theoretical physics dreamed of possibilities to study there. At the beginning of 1970s Nordita accepted graduate students who had finished their master degree at their home institutions. The idea, I believe, was to let them work on their doctoral thesis under the supervision of Nordita professors. From Finland Nordita accepted 3-4 students for two-year periods. Alpo suggested that I apply and I was accepted together with Pekka Haapakoski from the University of Helsinki and Carl-Gustav Källman from Åbo Academi for the period 1973-75. We all had small children and, of course, being Finns stuck together. In summer 1973 my wife and I made an excursion to Copenhagen to check housing possibilities. It was very comforting to find out that Nordita secretariat had reserved us a modern house in Albertslund, at that time a fashionable community with flat roof white houses designed for young families. The house was just renovated for us and furnished with smart Ikea furniture. All neighbors had small kids and the kindergarten for our two sons was nearby. My wife was happy.

Financially the Nordita stipend was fine. An additional plus was that I could keep 70% of my assistantship salary from Oulu during my leave of absence. In this way Finland wanted to encourage international exchange of researchers. Another attraction, which still exists, was the possibility to buy a tax-free car. In Copenhagen they sold cars tax-free to foreigners and after one year one could take the car to Finland without paying taxes. The best buy was the most expensive car one could afford. A downside was that Finland allowed only very limited sum of valuta exchange. We decided to go for Mercedes, but quickly we learned that the waiting time for a new car was more than a year and we gave up the idea. In the fall 73 the international oil crisis tripled the gasoline price and nobody wanted to use cars anymore. Car dealers had now many Mercedes cars in stock and before Christmas we could choose which one we wanted.

In my graduate thesis I had worked on a problem of isomer shifts in ^{209}Bi using a model developed by Ben Mottelson and Ikuko Hamamoto. It was then natural for me to approach them in the beginning of my stay. However, it turned out that I had developed a program which solved a

set of coupled Schrödinger equations and Gerry Brown had given Pekka Haapakoski a problem on nucleon-nucleon interaction in the deuteron, which needed exactly that program with some simple modifications. So, I switched into their team. After the role of the rho-meson in the deuteron was solved we wanted to include the contribution of the Delta resonance into the nucleon-nucleon interaction. That became my doctoral thesis problem. Later when Andy Jackson and John Durso came to Nordita I got world class help in developing the model. One inspiration was the lecture series Gerry gave on the nucleon-nucleon interaction, which he later published as a book together with Andy.

I enjoyed very much the relaxed atmosphere of discussions during lunch hours and coffee breaks in Nordita. When Gerry was in Copenhagen he was always reachable and very helpful. Of course, he disappeared every once in a while to Stony Brook. But then Andy replaced him and the work continued with refined details. At some point I had to present a seminar of my results. Rules were such that I had 20 minutes time to pose my problem and then professors and other fellows from the audience took over the discussion asking some questions, but mainly making their own suggestions. Very exciting for a young fellow, but I was treated gently.

In the family side my wife Anja wanted to create her own social circles and one way to do that was to learn Danish in a language school. We found the KISS-school (Københavns Intensive SprogSkole) at the center of Copenhagen. They had a very rigid method of teaching. Students had to learn 15 Danish sentences by heart for every lesson – three lessons a week. If one did not remember those sentences no mercy was given and one could not advance to the next level. There were eight levels to pass during one winter. So, when our boys went to bed in evenings we were learning Danish sentences. In parties among classmates discussions in Danish were simply exchanges of those well-chosen sentences. Later when we traveled in Denmark people assumed that Anja was born in Bornholm because of her light accent. She took that as a compliment. Our sons spoke Danish without an accent, but their Finnish sounded funny. After the language school Anja wanted to get a job. As a professional teacher she applied for jobs both in Copenhagen and Malmö. From both places she got an offer, but the one from Malmö came first and it was a permanent elementary school teacher's job and she took that. No bridge was built then and every school morning at six o'clock she took the hydrofoil from Nyhavn to Malmö. On stormy mornings that was the only hydrofoil to sail over. The later ones were canceled and people had to take the big, slow ferry. At five o'clock in the morning we got up listening for the power of winds with some concern. During that winter the first hydrofoil was never canceled. After Anja left in the morning I prepared

the breakfast for the boys, took them into kindergarten, bicycled to the S-train station and left for work. We got lifelong friends during our stay in Copenhagen.

The collaboration with Gerry and Andy led to many visits to Stony Brook. Nordita served extremely well one of its purposes to connect young researchers from Nordic countries to the international science community. We also remember with gratitude the kind and valuable help we received from Nordita secretaries. In particular, we still admire Helle's impressive way to run administration and money issues during the fellowship time and later visits to Nordita.

Henrik Smith, Denmark, Board member, 1984-1996

A View from Across the Park²

I started my undergraduate studies of physics and mathematics in 1959 at the Niels Bohr Institute on Blegdamsvej. In the beginning sixties, research at the Niels Bohr Institute and Nordita was dominated by nuclear physics. Solid state physics was completely absent until 1960, when H.Højgaard Jensen was lured away from the Technical University to take up a chair at the University of Copenhagen. Højgaard's lectures on solid state physics in Auditorium D on Blegdamsvej were the most stimulating physics lessons I had attended. Apart from this, my graduate studies were increasingly marked by confusion, and I even contemplated a change of career. However, Højgaard's clear and elegant lectures and the simultaneous build-up of a solid-state group at the H. C. Ørsted Institute on Nørre Allé convinced me that physics, after all, might be fun and could even provide the basis for a living.

In the summer of 1964 I participated in an 'Enrico Fermi' international summer school on superconductivity in Varenna at Lake Como in Italy. This was the golden age of superconductivity with the Bardeen-Cooper-Schrieffer paper of 1957 followed by an explosion of applications as well as novel and more general formulations of the theory. My own understanding of the topic, however, was much limited by the 'read-only' mode that had characterized my graduate studies. In fact, I did not even realize what was missing from my training, that the only way to understand physics is to work out a problem from scratch on your own, preferably without any books in reach.

John Wilkins changed all that. In fact, to be more precise, it was Villa Monastero and its beautiful view of Lake Como together with a bottle of scotch that became the foundation of a life-long friendship with John Wilkins and my experience of a much different, hands-on attitude to theoretical physics. John had done his thesis with Bob Schrieffer at the University of Illinois in 1963 and had spent the following year in England at the University of Cambridge. He was already an experienced and accomplished physicist, due to become an assistant professor in the fall of 1964 at Cornell University, although he was only one or two years older than me. I felt very much behind, but also enormously stimulated by John's no-nonsense attitude and his many humorous remarks on the school and its speakers.

²Excerpted from a more extensive account

However, having met John in Varenna turned out to be the lasting benefit of the summer school. John was in close contact with Stig Lundqvist, who had been a professor in theoretical physics at Chalmers Tekniska Högskola since 1963. Stig was the charismatic leader of condensed matter physics in Sweden and a man of many talents (he had supported himself during his studies as a jazz musician playing both the piano and the trumpet), and he had invited John to spend the first half of 1968 in Gothenburg. When I learned of this, I suggested to John that he combine this visit with a stay in Copenhagen. To obtain the necessary funding at short notice, however, was far from simple in those days, long before the advent of large research centres with funds at their free disposal.

Here Nordita came to the rescue. John's arrival on the Nordic scene in February 1968 coincided with the realization that Nordita itself needed to pay much more attention to solid state physics by - among other things - hiring permanent staff within that area. John was the ideal person to shake up the different physics communities in the Nordic area, make them aware of each other's work and start talking to each other. He was also a constant source of encouragement to young people, who had engaged in research on solid state physics, and helped them through his contacts to spend time abroad, away from the familiar surroundings of their home institutions. With support and much encouraged by the resonance in the respective physics communities, John spent the spring of 1968 shuttling back and forth between Chalmers and the H. C. Ørsted Institute, asking innumerable questions at seminars and offering generous advice and critique to everybody.

John came back to the Nordic area several times in the seventies on extended stays. In 1972-73 he was Nordita Visiting Professor at the Ørsted Institute in Copenhagen and Chalmers in Gothenburg. In 1975-76 he was Visiting Professor at Nordita in charge of starting the solid state program, and he returned again to Nordita for a two-year stay in 1979-81. To get a perspective of his impact on solid state physics in the Nordic area it is important to remember that he maintained a keen interest in and understanding of all the major topics in what we now call condensed matter physics.

As the solid-state activities in Denmark grew in size and scope during the seventies, long-term visits from abroad became more common, and here Nordita played a crucial role. The flexibility and diversity of the guest program at Nordita allowed institutions to attract visitors at short notice with a minimum of red tape. As a result of the student uprising in 1968 the Danish universities had come under a new governing law, 'Styrelsesloven', in 1970. The law greatly increased the influence of students and young faculty on both teaching and research, and it had many positive effects. But it also tended to slow down decisions, sometimes maddeningly so. Nordita,

of course, was under a quite different regulation through the Nordic Council, and decisions to hire staff or fund activities could be made much more rapidly. I always thought of (and occasionally referred to) Nordita as the Wild West of endless opportunities - open to initiatives for anyone with a gun to shoot and a horse to ride. The seventies also saw a considerable expansion of condensed matter physics within the permanent staff at Nordita itself. For me the most significant addition to the faculty was that of Chris Pethick, who was a professor at the University of Illinois in Urbana.

Dr. Bill Brinkman, whom I had met previously at Cornell and talked with only briefly at the Summer school, arranged by Vinay Ambegaokar, in Kiljava, Finland in 1971, would be an excellent candidate for a Nordita guest professorship. Bill was hired as a staff member at Bell Laboratories in New Jersey. The chances that Bill would be able to accept an offer to come to Copenhagen as a Nordita guest professor in 1974 seemed therefore slim. Nonetheless, encouraged by the Wild West opportunities of the Nordita guest professor program, I wrote to Bill in 1973 to explore the possibilities. And to my delight he said yes.

Bill arrived in Copenhagen as a Nordita guest professor in January 1974 together with his wife Carol and their two sons David and Curt. Anne-Marie and I became very close friends of Bill and Carol, who were both eager to learn about Denmark and explore the attractions of Copenhagen. They had sublet Niels Meyer's home in Hørsholm (not an easy word to pronounce), and Carol struggled with learning words like 'smør' (no Carol, not smor, but smør). Eventually, we gave up on the vowels and focused on having fun together. The oldest son David thrived at the Bernadotte School, where teachers and pupils explored new ways of learning.

Right after his arrival Bill and I started working together at the Ørsted Institute. The newly discovered superfluid phases of liquid He-3 were a hot topic. Doug Osheroff had made the discovery in 1972 during his thesis work together with David Lee and Bob Richardson at Cornell. Upon graduation Doug was promptly hired by Bell Laboratories, where he set up a low-temperature laboratory that allowed him to explore the nuclear-magnetic-resonance (NMR) properties of the new phases. Being so close to Doug's experiments made it even more exciting to jump into this field. Many distinguished theorists, including P. W. Anderson and Tony Leggett, were already there, but the opportunity of being able to collaborate with Bill for six months removed any doubts in my mind that this was the right thing to do.

We focused initially on trying to understand some characteristic shifts in the NMR spectrum, which Doug had observed in the so-called B-phase of superfluid He-3, and it became all the more exciting when Doug arrived

in Copenhagen during the spring with new data. This gave rise to a joint publication in *Physical Review Letters* (with E. I. Blount), and Bill and I also wrote a paper on collective modes during his stay at the Ørsted Institute.

Bill's stay in Copenhagen as a Nordita guest professor was the ideal opportunity to get into a new field, where the low-temperature group in Finland was already very active. I went to Olli Lounasmaa's low-temperature laboratory in Helsinki in August 74 to tell the group about our results. My closest contact there was Matti Krusius, who measured NMR spectra in the superfluid phases, but I also learned about the group's measurements of viscosity in the superfluid phases. On returning to Copenhagen I suggested to Chris Pethick that we should look at the viscosity issue together, given our experience with transport properties in normal quantum liquids. This marked the start of a collaboration that stretched over more than thirty years. We wrote several papers together in the next couple of years on transport and relaxation, using small parameters such as the ratio of the energy gap divided by the Boltzmann constant to the temperature (or its inverse) to get analytical results.

My collaboration with Bill Brinkman continued over the next few years. He invited me to visit Bell Laboratories for a three-month period in the spring of 1975, and I went back again in 76 and 77 and at several times later. Each time I visited Bell, he had assumed more management responsibilities - as department head, director, executive director, culminating in the vice presidency for research - but in the seventies we still managed to write papers together. I was particularly fond of our explanation of Doug's NMR experiments on nonlinear effects, where he measured the shift in magnetic resonance frequency as a function of tipping angle. When Doug received the Nobel Prize in 1996 together with David Lee and Bob Richardson he graciously invited Anne-Marie and myself to join the party, and we spent a wonderful week in a sea of champagne in and around the Grand Hotel in Stockholm.

Håkon Snellman, Sweden, 1966-1968

Some Reminiscences from Copenhagen and Nordita 1966-1968

In August 1966 we loaded our old Volvo Amazon and set out from Uppsala in Sweden for Copenhagen. I was to attend a two year fellowship at Nordita and my wife would try to pursue her medical studies at Rigshospitalet in Copenhagen. We had our son hardly two months old with us. At the customs office in Helsingør they became interested only in our car that we had not so high opinion about. Finally we settled in Skovlunde, just outside of Copenhagen. I took the S-train to Østerport in the mornings and had a pleasant walk to Nordita at Blegdamsvej 17 by foot. Nordita was a highly dynamic place with many visitors, as it was also associated with the Niels Bohr Institute. The Nordita staff included Jim Hamilton, particle physics, Christian Møller, relativity theory, Ben Mottelson, nuclear physics, among others. Gerry Brown from Stony Brook was a guest professor who invited us to a pajamas party. At the Niels Bohr Institute Ziro Koba worked and he kindly invited all fellows for a dinner party. Many visitors came by, e.g. P. A. M. Dirac, H. Lehmann, M. Gell-Mann, S. Glashow, M. Veltman, D. Olive – even Oscar Klein was there for a short while. In the summer of 1967 we moved to Gentofte, and I could bike to the Institute. Gentofte was a wonderful place with magnolias in the garden, a huge pear tree and a walnut tree that unfortunately fell in a storm. Behind the garden was a train track and when the train did not come on Sunday mornings we woke up from the silence.

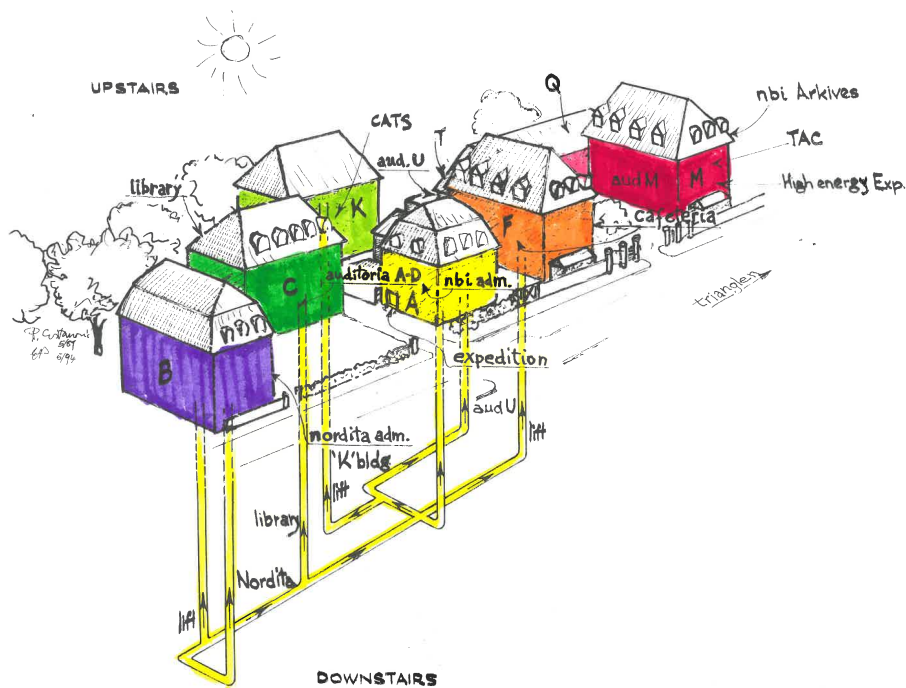
In our free time we went to Louisiana on Sundays and in the summer we spent time at the beach of Tisvildeleje. My wife had a school friend who had married a Danish physicist working at the Technical University, and we met their family regularly. At Nordita there were many students from the Nordic countries studying various fields in physics. From Sweden came Thorvald Forssner and Stig Jägare. Stig studied nuclear physics and was instrumental in teaching me to enjoy *surstömming*, a North-Swedish special dish of fermented herrings to be eaten in the early autumn, preferably with some snaps. Lars Söderholm from Stockholm worked on relativistic thermodynamics and Gösta Gustafsson from Lund worked on general relativity. Gerry Brown had a student, Martin Einhorn, who later made a successful career in theoretical physics. Martin married a Danish wife before he went back to US. We have been friends and kept contact ever since that time. Another student at the Niels Bohr Institute that interacted with us was Holger Bech Nielsen, a student of Koba. John Nagel gave a course

in group theory with applications. At the end of the course Holger won a bottle of wine by solving a complicated homework problem. Christofer Cronström from Finland was also a student at Nordita that time. We have also stayed friends ever since. Other students I remember was Jens Lyng Petersen, a student of Hamilton, who was always very kind and willing to discuss physics and share his knowledge. Henry Nielsen introduced me to Danish literature and poetry which was highly appreciated. Jim Hamilton was an expert in dispersion techniques applied to pion-proton scattering. He was quite skeptical to quarks as dynamical particles though, claiming that the vacuum polarization would be too strong in a proton. This was before asymptotic freedom was discovered. I took notes of his lectures in dispersion techniques for pion-nucleon scattering and helped editing his lecture notes. My own interests was in the area of current-algebra techniques, to unravel the strong interaction physics. In the autumn of 67 we created a small group that studied Bjorken current algebra techniques at short distances. This became a useful connection to the idea of dynamical quarks. At the end of April 68 our daughter was born. The summer of 68 was a busy period with many visitors and a mini conference on contemporary problems in particle physics. By the end of the summer 68 we moved back to Sweden to settle in Stockholm.

Bent Sørensen, Denmark, 1965-1967

The Buildings

The Niels Bohr Institute is a collection of 7-8 buildings of different size. Several of the buildings are connected and in spite of the fact that the height of the rooms of the individual buildings differs, it is at several places possible to walk from one building to the next. A couple of staircases up or down and you find yourself in a room with another architecture. Of course one has to know the construction to find ones way. One floor up to go from C to D building, then two floors down and round a corner the result: the room adjoins the room you came from.



Map of the Blegdamsvej buildings drawn by Predrag Cvitanović (1984) and edited by Ellen Pedersen (1994).

Beneath most of the buildings one has basement rooms containing experimental laboratories, and a complicated network of paths and corridors connect the different subterranean departments. The advanced staff member knows it is often the fastest way between the buildings to use these corridors. A couple of steps down, fast steps through two right-angled corridors, up again and round takes one from the A-building to the barracks above the cyclotron laboratory. Several of the NBI buildings are ‘temporary’ barracks, which have just been there for 30, 40 or 50 years. The best and quickest way to the canteen, today placed in the F-building, is, during the summer, to go outside, cross the yards and enter from the back door in the little garden, and, during the winter, to go down to the corridor in the basement, through the Van de Graaff laboratory, a door looking exactly like all the other doors, and up in the basement of the F-building. When the Van de Graaff generator is in use, one should not stop for a conversation on the way in the corridor under the bicycle shed as there under unlucky circumstances could be radioactive radiation.

When I had an office at the institute I shared this with a visiting scientist from Japan, with whom I had a good talk towards the end of the week. Monday he did not speak English because, as he explained, English and Japanese were two ‘orthogonal’ languages, to him anyway. They could not be in the head at the same time. After a weekend with the family all English was blown out and only gradually returned during the week.

Bjarne Tromborg, Denmark, 1969-1971

From Dispersion Relations to Optical Communications

I had a fellowship at Nordita 1969-1971 and at NBI 1971-1977 where I was associated the “Nordic Dispersion Relation Group” headed by Prof. James (Jim) Hamilton. The focus of the group was on application of dispersion theory to analyze experimental data on elementary particle scattering at low energies. For my master project I had chosen a rather academic topic in mathematical physics so I was quite happy to change to a topic closer to the real world. I had most of the time a close and enjoyable collaboration with Jim Hamilton, whom I respectfully admired and considered as a fatherly mentor.

The years 1969-77 coincide fairly precisely with the period where the Standard Model was established as the ruling model of particle physics. Being a young researcher in the middle of a revolution of your own field would seem to be a dream opportunity. Alas, I did not see the key patterns of evidence in the background of noise of competing theories until it was too late and I did not take part in the revolution. In retrospect that colors my memory of this period more than forty years ago.

For the members of Hamilton’s group there was in the mid seventies a growing feeling of being outside the general progress of the field. That feeling was supported by some of our young colleagues at NBI and other Scandinavian universities who were very successfully contributing to the new physics and who did not suppress their view that Hamilton and his group were blind to the new progress. Most group members changed to other fields after going back to their home universities. The decisive blow came when a key member, Jens Lyng Petersen, left the group in 1976, after which the group was dissolved.

I had no job at the university after the summer of 1977, so I had to leave – fortunately just in time to join the technical revolution of optical communications. The best I brought with me from my time at Nordita/NBI is a number of close friendships that have since been a source of much pleasure.

John Wilkins, USA, visiting professor on many occasions

Recollections of a Visiting Professor

Some of the personal accounts Helle sent me had ‘mistakes. But thinking about my memories I am sure there are mistakes. So let me pick the high points and how they influenced me and perhaps my associates.

1. Nordita had a very generous spirit – not only funds but more broadly improving interactions between scientists in the Nordic countries. I was encouraged to support that. I did try but wonder how much more I could have done. But I picked up its spirit and tried to do likewise in other places – my two permanent jobs – Cornell and Ohio State (or OSU)– plus other places I visited. Altogether I had extended stays in Nordic countries in 1968, 1972-73, 1975-76, and 1979-81.



John Wilkins and Helle Kiilerich at the retirement reception for Nils Robert Nilsson, 1993.

2. Noteworthy is that Nordita encouraged me to bring my students and postdocs with me. Almost all did come and enjoyed it, in addition to the stimulus they got with their research.

Once I saw how well that worked, I used it on other visits. Besides Nordita, my other long stays were at the (later Kavli) Institute for Theoretical Physics at Santa Barbara where I helped co-organize longish (several month) programs of visitors and speakers (1985-86, 1991) plus a stay in 1994. The Institute saw the advantages and encouraged others to bring postdocs and created an award for graduate students to visit.

3. One surprise was that many had trouble adapting to moving. So I quickly learned I had to liven up their stays. A small effort made a difference. Judging by the two personal accounts Helle forwarded to me, that effort paid off. While Nordita was welcoming, it didn't seem exceptional to me at the time. Thinking back I now realize the efforts it made and encouraged made a greater difference than I appreciated then. Perhaps here is a lesson for all institutes. Of course duplicating Copenhagen is seldom achieved elsewhere. The institutes' service in finding housing is a real plus. Witness how important that was in one of the personal accounts.

4. One aspect that is perhaps not as used as it should have been, I felt my appointment involved reaching out to all the Nordic institutes. After I was no longer associated, that spirit still moved me. And I agreed to tasks that required me to visit all relevant institutes in Norway (1985-6) and Sweden (1991-2). I regret I never did a systematic visit in Finland that I am sure Nordita would have encouraged. Once when Finland did sponsor a bi-annual Low Temperature Conference, I did recognize that Finland kept the costs low by using its graduate students who would be so busy they would miss some science at the meeting. Nordita paid for a several-day meeting in the Finnish outback just for them, using some of the best visitors to give talks and spend time with the students. How many of those opportunities did I miss?

5. While I could tell many stories, I have concentrated on possible lessons I learned. One other activity at Nordita did influence my behavior in the US. At Nordita I took every speaker I invited, junior or senior, to dinner. I discovered that conversing was easy and pleasant. Back at Cornell and increasingly at Ohio State, I again took every speaker to dinner and since I had more funds, I could always invite two more to the dinner (At Nordita I paid out of my pocket, but more relevant I felt uncomfortable forcing Danes to accompany us— why now I cannot say.) It turns out that meant I got to know many I would not have just from a visit in my office. I have subsequently learned that visitors often remembered this stay as different than most. Part of that was due to the fact that we (my secretary at the time and I) prepared a schedule for each visit during which the visitor met many staff (junior and senior) at Nordita. I continued that at Cornell and

OSU. Subsequently I discovered that a schedule with full names and contact info for each meeting was special. At other sites, there is often no schedule and certainly no details on whom they meet. In summary, small repeated behaviors pay off.

Sven Åberg, Sweden, 1980-1983

My Relations with Nordita in Copenhagen

My regular visits to the Niels Bohr Institute and Nordita started in 1974, during my time as a PhD-student of Sven Gösta Nilsson in Lund. This was of course the Mecca of nuclear structure theory for my start in science, giving the opportunity to meet many internationally well-known scientists that visited the institute, certainly attracted by the scientifically lively atmosphere around Ben Mottelson and Aage Bohr.

After my graduation I spent my postdoc time as a fellow at Nordita, starting in 1980. With the excellent research conditions at Nordita I could indeed deepen and broaden my nuclear theory research. After an added third year I returned for a position in Lund in 1983. During the three years as Nordita fellow, every day I took the hydrofoil boat from Malmö at 8 am and returned with the 5 pm boat. This was except for the winter in 1983 when the ice was extra thick, and the route had to be taken either via Helsingborg/Helsingør, or via Dragør. Each alternative needed more than three hours travelling one-way, and my trip was not daily. Instead, I spent the night on the floor of my Nordita office, and could in that way limit my travelling.

Also after my postdoc time I was a frequent visitor to Nordita, either for seminars or for scientific discussions. Copenhagen and the Institute remained a central scientific place, with a broad theoretical activity on the highest level. Nordita was indeed a very important scientific institute for my research and development.

Much later, in 1996-98, I was a corresponding fellow at Nordita. I then regularly attended the professors meetings on Wednesdays. One of my passions was the support of young students, and I suggested the setting up of the Nordita Master Class in Physics, aimed for excellent undergraduate physics students in the Nordic and Baltic countries. During the Master-Class week, four internationally well-known senior physicists lectured over exciting topics, with plenty of opportunities for the students to interact, learn and discuss physics. In the discussion of the four lecturers for the very first Master Class in 1997, we thought that at least one of the lecturers should be a female; we ended up with three outstanding women scientists with renowned pedagogical skills as well (Professors Cecilia Jarlskog, Sara Solla and Mildred Dresselhaus), and one man (Professor Bengt Gustafsson)! I was the Director of the Master Class the first three years. The Master Class has since then been a regular Nordita arrangement, also after the move to Stockholm.

The Second 25 Years

Marek Abramowicz, Poland, assistant professor 1991-1993

From Trieste to Nordita to Gothenburg

My three years on the staff of Nordita and the subsequent long-term Nordic cooperation, after I left Copenhagen to be professor of astrophysics at the University of Gothenburg was the result of the most serious crisis of my life. In the spring of 1989 I took part in a small, two-week-long workshop on Nordita, which dealt with selected fundamental problems of Albert Einstein's general theory of relativity. I came to Copenhagen from Trieste, where for five years I was an untenured professor at SISSA, in the group of Dennis Sciama, who had moved there from Oxford together with his team, of which I was a member. In Copenhagen, I was waiting for a call from Dennis. He was due to call immediately the Italian Minister of Education officially announced that I had won the competition for a tenured professorship at SISSA. I was waiting for the outcome without a trace of anxiety because I was supported by some very influential Italian astrophysicists, so when Dennis rang up with the news that the ministry committee had chosen someone else, I was shattered. My contract in Trieste would expire in a few months, and I did not have a plan B. The fact that I was in Copenhagen at this difficult time was the happiest piece of luck, since the Nordita workshop had gathered a few world leaders who immediately started a successful rescue operation.

Martin Rees first found a practical solution. After several quick telephone consultations with colleagues in England, he offered me a year at Cambridge as a senior visiting fellow, with a prospect of longer employment, if after a year I would win a Cambridge competition. It was a luscious proposition. It gave me time and additional strength in finding a new job; It is easier to find a good job at a good university when sending applications as a senior fellow in Cambridge.

I returned to Trieste completely calm. A few days after my return, Chris Pethick, then the Director of Nordita, called me. He surprised me by suggesting that from the autumn I worked for Nordita as a visiting professor for a year and then entered the competition for a 6-year position which Nordita was planning to announce. "But Chris," I said, "you know that I already agreed to Martin's proposal and that I was going to Cambridge". Chris

expected such an answer. “We sent you a letter with a detailed discussion of the conditions of your employment in Nordita. Read these through, and then give us the final answer.” Why did I choose Nordita? In the letter Chris wrote mainly about the mission, ethos and tasks of Nordita; Very well, because before that I did not know much about them. I knew, of course, like any physicist, a legend in the same building at Blegdamsvej, the Niels Bohr Institute, an address and a place that has been the Mecca of theoretical physics ever since the 1920s. Blegdamsvej was visited by all the best. Niels Bohr had his famous disputes with Albert Einstein concerning the essence of physical reality, Werner Heisenberg came and worked there, Paul Dirac, Lev Landau, Wolfgang Pauli and other famous physicists. I also knew that there were two Nobel Prize winners, maybe my future colleagues, among the permanent professors of the institutes there. Chris explained that the main mission of Nordita is to assist the Nordic (i.e. Danish, Swedish, Norwegian, Icelandic and Finnish) scientific research on theoretical physics. I learned that most of the research was conducted on site in Copenhagen under the supervision of a small team of permanent professors and professors employed on several year contracts. Young physicists, mainly from the Nordic countries, receive Nordic grants and scholarships. Nordita also organizes seminars, conferences and workshops in Copenhagen and other Nordic countries and financially supports the organization of such events by Nordic physicists not formally connected with Nordita.

The Nordic Council of Ministers, is the designated governmental body that takes care of cooperation between Denmark, Sweden, Norway, Iceland and Finland. I understood that if I came to Copenhagen I would have ideal conditions for research, the world’s best professional colleagues on the spot, constant contact with famous Nordic physicists, solid Nordic research facilities, great academic planning, complete academic autonomy and comprehensive help from a team of experienced secretaries. Everything was great, but there was one “but”. My children were completely disoriented at the time. They lived in Rupingrande, a rich countryside near Trieste, at the same time in the mountains and by the sea, where we rented a large house, and they enjoyed Italian cuisine, wines, landscapes and mild Italian customs, and above all the literary Italian and local dialect of Trieste, and they had already made up their minds. The fears were justified, because the children had said very definitely that they would not move from Italy to Denmark. My wife, who lived and cooked in Italian, also did not want to leave Italy. We finally reached a compromise. I would go to Copenhagen alone, and they would join me after a year - if I won the competition for a six-year career at Nordita. Fortunately it was possible financially. Nordita arranged with the Danish tax office for my full tax exemption for the first year of work at

Nordita. As the taxes in Denmark are very high, this doubled my salary. So I was able to live alone in Copenhagen, while ensuring a good standard of living for my “Italian” family in Rupinjska. My children and wife accustomed themselves to a year’s leave, reading Andersen’s fairy tales from the classic, three-volume collection of Polish translations prepared by Jaroslaw Iwaszkiewicz; we liked “The Shadow” (“Skyggen”) and “Heartache”.

On the first day at Nordita, Chris introduced me to my new colleagues. We also went to the library. “Let me introduce Marek Abramowicz, Nordita’s new staff member,” he said. The librarian looked at me with clear amusement: “Oh, finally! So you are this Abramowitz whose book is always stolen!”

At Nordita we did not have students (undergraduates) or course lectures. Of course I fully appreciated the luxury of isolation from all duties and care, but even in such an elite ivory tower, I could not imagine living without students and without regular lectures. So I agreed with my colleagues at the nearby Lund University that I would give them a half-year lecture on black hole accretion. One of my students in Lund was Ulf Torkelsson, later an invaluable professional assistant at the University of Göteborg, a colleague and a friend.

I often travelled outside Copenhagen to lecture at universities in Denmark and in other Nordic countries; This is how I got to know most of the Nordic university towns.

My wife and children came to Copenhagen from Italy in the autumn of 1991, after my first year at Nordita. We rented a small house with a garden in an elegant neighborhood in Hellerup. The children went to the nearby private Rygaards International School. I cycled to work on Blegdamsvej daily, and in the evenings I ran for the longest time, mostly to the famous royal park in Klampenborg, from where I usually came back at dusk.

But the first year I lived in Copenhagen alone, in a modest room with a bathroom, at Mrs. Barfoed’s. She was a thirty-year-old lady, very rich and well-educated. Due to illness she often moved in a wheelchair. Her schooling ended in England, which was immediately heard in conversation, since she spoke idiomatic English with a beautiful accent. She had a huge, multi-room apartment, stylishly furnished, full of paintings and works of art. It was located on the third floor of a magnificent building on Classensgade, with its many shops and galleries with antiques. Mrs Barfoed had always rented only one room. All its tenants were young scholars, recommended by the University, Nordita or other trustworthy Copenhagen academic institutions. She charged only a symbolic sum, nothing much. It was not about money, it was about interesting company. It was like being in an elite club or Oxford college. By chance, during some social gathering at a party or in

a theater break, I discovered the same magical connection between me, my interlocutor, and the room.

At Classengade 17, it always aroused immediate sympathy and led to nice conversations and nostalgic memories. For Mrs. Barfoed's old-fashioned apartment, she herself, a world-style lady, Scandinavian beauty, dresses, jewels and hairstyles, her simplicity, reserved with courtesy and practicality, were enchanting, immediately recognizable, fairy fairy tales from Andersen's fairy tales. Mrs. Barfoed brought her antique, but well-functioning radio receiver, on the first day, and said, "You would like to hear the BBC news. Turn it on. You can keep the radio for as long as you like".

I liked the afternoon tea at Classensgade 17. Every Thursday when I lived with her, Mrs. Barfoed invited me to her room for five o'clock biscuits and tea. We talked about books, religion, Catholicism, new vernissages on Classengade, but also about their own fates, families, siblings, children and travel. One Thursday, I talked about my work in Oxford, my lectures, my students and my Oxford college. Mrs. Barfoed looked at me with an unmistakable astonishment, and so she gave me the advice I had listened for – "Marek, judging from your command of English after three years in Oxford, you will never learn Danish. Do not even try."

Mikko Alava, Finland, 1996-1998

Beer and Statistical Physics

I joined Nordita as a Fellow in 1996. I had spent the previous year in the US at my first real postdoc as the final step in an attempt to get out of plasma physics (my PhD topic) and into statistical mechanics. At the time Copenhagen – as it still is – is the most international of the Nordic capitals and that was something. Not that there is anything wrong with the current Nordita home Stockholm, but Helsinki and the little college town I spent the previous year at were another story. During my time there was a vibrant Fellowish atmosphere on one hand (the now extinct Clock Bar is a keyword, as would be playing soccer in Fælledparken); I discovered also some local life in terms of sports (say hi to Rødovre Floorball and among others Jens who could speak Swedish since he had played ice hockey in Åbo in Finland and thus interpret what the coach was saying). In this international atmosphere I also met Laura from Italy and the rest is history (and present and future) - The general cultural immersion can be best summarized by a comment by an old guy at a bar along one of the Sørerne during a workshop some years after: “Hey, listen – this guy can say sixteen in Danish”. As in sixteen Danish crowns for a Carlsberg. And now we get to statistical mechanics and beer.

Statistical physics at the time at Nordita was John Hertz – a slight downsizing in faculty from what it was just before, but the CATS center and the science at NBI were really going strong those days. I learned to know somewhat the older crowd in spite of the fact that I was working in disordered systems to start with, not a topic of focus for CATS, and much better (ahem, see above) the younger ones of similar age like Kent Lauritsen, Martin van Hecke, Per Fröjdh, and Martin Howard. Their interests were in non-equilibrium systems: phase transitions, self-organized criticality and what not and this left me with a lasting impact that I feel to this day. However it happened to become so, in 1997 disordered systems and beer collided: it was about finding the ground state of a random landscape. Carlsberg organized in Denmark a beer election in other words, which was about selecting the one beer out of six novel ones put on sale. An observant reader now immediately notices the equivalence of the ground-state problem with spin glasses on hypercubes (pick one of the states (100000), (010000), ..., (000001) according to its energy). The algorithm chosen by Carlsberg was a crowd application of steepest descent, a public vote to select the most optimal one. Now this kind of greedy approach is not supposed to work

with complex landscapes, but the result (the beer Carls Special, still on sale) seems to be a long-lasting metastable minimum at the very least if not the optimal beer in the hypercube. I later contributed to the theory of local search methods in complex energy landscapes by a couple of papers (eg. in PNAS 2007), when the multi-spin interactions of a spin glass (or a K-SAT problem of combinatorial optimization) on a hypercube make the task hard. The question is how to find the optimal solution when it is difficult to sample the landscape enough (however pleasant, it may be costly). This is in particular true since the Danish beer hypercube has expanded tremendously since 1997. The most recent encounter of beer and statistical mechanics in the spirit of this contribution comes from the question whether you can figure out in a bar if the beer is consumed in a correlated way? The simple abstraction to this is to take N people (who in jargon share all the nickname ‘spin’). They consume beer in quanta, one at a time (‘a sip’, or flip the glass for a moment) or do not (0). The patrons can be independent or interact. Just around the corner from the current day, in 2013, we looked at this in a collaboration – on a hypercube – involving me, Hongli Zeng from Aalto as a Nordita visiting PhD student, the current Corresponding Fellow Yasser Roudi now from Trondheim, Erik Aurell (KTH), and who else if not John Hertz. The paper published in *Phys. Rev. Letters* makes the simple but quite deep point that one should look at the correlations among the beer mugs as time passes. If glasses X and Y get emptied almost in unison, then the two patrons of the bar are probably at the same table. This way of inferring the interactions of agents is surprisingly powerful, and it is based on the accidental discovery – that John then in a tour de force put on a solid theoretical ground – that the lack of information is very informative. Think of two glasses that are left untouched for a while, both. Now we may not know if the two beer drinkers thought both of drinking some (or flipping the glass) or did not do so, but since we know that they may have done so this means there is already a correlation that arises from nothing happening in mugs X and Y . In spin systems this means that knowing the flip attempt history is of advantage, even if you see only the successful flip attempts.

At the borderline of materials science and non-equilibrium statistical mechanics the hottest topic right now is to guess how to describe the transition to flow (yielding, solid-to-viscous, ...) in non-crystalline media, including, e.g., cell assemblies and bird flocks and crystalline materials alike. What kind of phase transitions could there be? And what would be the experimental and practical consequences of this complexity? This frontier of research is exciting since it broadens further and further the scope of the theory needed here, but it does have also even economic impact. A perfect example to this end is the yielding and mechanics of foams. ‘Simple’ foams are already

a quite complex system with several relevant scales in time and space and ensuing correlated phenomena. What industry, including, in particular, the brewing industry, is doing here is to combat the non-equilibrium nature of the foam state of matter by adding stabilizing particles. These change foam physics fundamentally, and I myself hope finally to be able to contribute to the subject in the near future.

Tobias Ambjörnsson, Sweden, 2003-2005

Memories of a Fellow in Biophysics

After my PhD period (Gothenburg University, Sweden), I was fortunate enough awarded a post-doctorate fellowship at Nordita. The years at Nordita (2003-2006) allowed me to switch topics from my Ph.D. topic, electromagnetism, and to enter the worlds of equilibrium and non-equilibrium statistical physics. Together with the head of the biophysics activities at Nordita at the time, Prof. Ralf Metzler, we studied non-equilibrium problems in relation to single macromolecules, particularly modeling of different aspects of DNA dynamics. After the end of my time at Nordita, I spent two years as a postdoc at MIT, working with Prof. Robert Silbey at the Chemistry Department. In 2009 I started a position at Lund University, where I am still affiliated to date (2015). My present research, bionanophysics, is close to the research I started while at Nordita.

I will always fondly remember my years at Nordita. All the kind people I met. The many stimulating discussions about science we had. Football in Fælledparken. Lunch discussions in the canteen with the other postdocs. Biking through Copenhagen on a summer day. Looking back, I cannot imagine myself spending those three years in my work life any other place than at Blegdamsvej 17.

Anja C. Andersen, Denmark, 2002-2005

Astrophysics and Astrobiology

I was at Nordita during 2002-2005 as a fellow working with Professor Axel Brandenburg. When looking back I always see it as a most enjoyable part of my research career. The astrophysics group was supportive and the whole environment friendly with a strong dedication to science. One of the things that made life absolutely amazing while being at Nordita was the very helpful support staff. There was always service for computer issues and infinite amount of patience when I had once again filled out the travel claim in the wrong way. Most important of all, then travel money was available, for all the conferences and research institutions where I had the opportunity for presenting a talk. This was crucial for establishing my research career. Another important thing that Nordita offered, which I see as essential when looking back, was the constant flow of guest researchers which came and stayed for longer or shorter periods of time to work with the Nordita professors and associates. The guests were encouraged to interact and the structure of talks, seminars, and coffee breaks made it easy as a young postdoc to get the opportunity to participate in scientific discussions on an equal footing.

Nordita Professor Axel Brandenburg was very dedicated to getting us, as a group, to interact and exchange ideas. Axel was extremely imaginative regarding where we, as a group with different expertise, could find research niches where we were able to contribute with unusual cross-disciplinary papers. So while at Nordita we published a handful of papers on polymerization and homochirality, relevant for astrobiology. We also organized three Nordic Conferences on Astrobiology in 2003, 2004 and 2005, as well as a conference for science writers, where we tried to explore how to engage science writers so that they would be more familiar with the scientific methods, thereby making them better at distinguishing good scientific results from less solid results.

Apart from my research career, which might never have flourished had I not had the good fortune of being a Nordita Fellow, then what I learned at Nordita and have tried to establish where I am now, is the value of a good support structure on IT and administration, and the importance of a good open environment with room for crazy, wild and sometimes wrong ideas to be explored and evaluated.

While at Nordita I served as the Fellow representative on the Nordita Board. It was a most frustrating task as it was during the period where political decisions, which I never really got to understand, were enforced.

The end result being that Nordita after 50 years in Copenhagen was moved to Stockholm. There are lots of things in that whole process which I still do not understand even today. But I must say that what makes me most happy to see is that Nordita also today is able to offer young postdocs the opportunity of being a Fellow. I hope this will continue for many years to come.

Lone Appel, Denmark, 1986-1990

Memories of an Astrophysics Fellow in the 1980s

In 1984 I was a student at the Astronomical Observatory (Copenhagen University) and was looking for an interesting subject for my master thesis. As I was more interested in theoretical than observational astronomy, it was suggested, that I contacted Bernard Jones (not to be confused with Bernard Pagel) at Nordita. It was not easy to get an appointment with Professor Jones, but after a couple of unsuccessful attempts, Bernard's secretary, Hanne, took over and arranged a meeting. This was the start of my years at Nordita, first as a master student officially at NBI, and later a Nordita fellow as a PhD student.

Nordita was very good to me. It provided an active and inspiring environment, where I was part of a group led by Bernard Jones. During the years, I shared a big room in the basement with 2-3 other Danish PhD students and many different guests from other countries. We all became good friends and could discuss our work with each other in an informal way. Financially Nordita was also supportive, allowing me to travel for courses and conferences and renewing my stipendium twice. Nordita's leading credentials were the professors, the fellows, the secretaries and all the other people associated with the institute. I wish to give a special tribute to my supervisor, Bernard Jones, who was a constant source of inspiration and attracted so many students and exceptional guests due to his broad knowledge and radiant personality.

During my years at Nordita I had two children, which changed my values. My family had higher priority than a scientific career and I knew I didn't have the strength to do both. I also wanted to try something else and teaching seemed obvious. Since then I have taught physics, chemistry and astronomy in the gymnasium. I'm very satisfied with my job and enjoy the multitude of challenges I meet every day. I am fortunate to teach some of the very best students and am sure my years at Nordita have made me a better teacher. I'm sure some of my students will contribute more to science, than I have.

Kirstine Berg-Sørensen, Denmark, 1998-2001

From Cold Atoms to Biophysics

In 1998, I was lucky to get a fellowship at Nordita, then still in Copenhagen. My previous appointment was at the Ørsted Laboratory of the Niels Bohr Institute, where I had concentrated on cold atom physics including Bose-Einstein condensation of dilute atomic gases and had thereby had scientific interaction with Christopher Pethick and Henrik Smith. At Nordita, administration was smooth and efficient, and we had time to concentrate on science. Copenhagen was not new to me either so starting my fellowship at Nordita basically just meant moving offices from Nørre Allé to Blegdamsvej.

Although my original research project dealt with dilute, cold atomic gases, I enjoyed the freedom at Nordita to change gears towards biophysics and now, looking back, having this freedom was luxurious and Nordita should be commended for that open-minded attitude towards their fellows. During my fellowship, I applied for and received a rather large research grant to start a new research activity with close ties to experimental biophysics, yet could stay on at Nordita without anybody complaining that I spent a bit of my time on actual laboratory work. In addition, I also gave birth to my second child – the administration related to maternity leave was not experienced too often at Nordita but Helle Kiilerich got everything to work out well.

Thus, the time at Nordita brought me from cold atom physics to physics related to optical trapping applied to biological systems, in particular single molecules both in artificial systems and in living cells. I am now associate professor at DTU Physics. I hope that Nordita also in the future will stay vibrant and open, providing just the right environment for research in (theoretical) physics to thrive.

Johan Bijnens, Belgium, assistant professor 1992-1997

Memories of an Assistant Professor in Subatomic Physics

I was born in Tongeren, Belgium in 1960 and, since I was very much interested in how things work at a deeper level, I decided to study physics. After my undergraduate studies in Leuven, Belgium I went to Caltech for graduate studies. During my stay at CERN as a CERN fellow I was encouraged to apply for an assistant professorship at Nordita in Copenhagen. This I was offered and we moved to Copenhagen to start my new position there. As is rather obvious when reading this book, Nordita is a rather special institution supported by the Nordic Council of Ministers. It was also my first faculty level job.

It was a very nice experience to have generous support for visitors and Nordic fellows and quite good opportunities to obtain postdoc positions for other countries as well. The atmosphere with friendly mentoring, even if you didn't always realize that was what was happening, and a broad set of activities in theoretical physics was really very good.

During my time at Nordita I did some of my best known work: muon anomalous magnetic moment and hadronic contributions as well as a number of papers on nonleptonic matrix elements and chiral perturbation theory. I think back with pleasure on how easy it was to start new things or organize small schools and conferences. The motto being, tell us what you want to do and then we can figure out how to do it.

I also got to know the Nordic community in my area quite well, resulting in getting a permanent position just across the sea from Copenhagen at Lund University where I am now a professor. On the other hand, I have kept long collaborations with several of the people I first encountered at Nordita. Nordita was the main reason why I ended up living in the Nordic countries.

On a personal note, both of my children were born in Copenhagen during my stay there.

Gunnlaugur Björnsson, Iceland, 1986-1989

Nordita 1987 – Recollections

Physics. Hard benches. Photographs of ‘the’ names in physics. Exciting. Blinking pentlights. Curious characters. Smoke. Physics of curious characters. Does phase matter in the pentlights? Hmm.

The buildings surprised, looked old, had character. Turned out to be older than the institute. Labyrinth, easy to lose track of location, also of time. Strong smell of physics everywhere.

Library. Place to sit and think. Sometimes read. Floorboards creaking.

Officicle in the attic. Third level. Nice, small and very hot and steamy in the summer heat. Packed with fellows. A square meter blackboard. Physics in the air.

Coffee at ground level. Danish. Cookies. Nice to see and talk to the secretaries, efficient and lively.

Helle. The mother of the institute and the fellows. The caretaker of visitors. Without her, well, can’t think of it.

Flux of visitors, many world-famous. Many new and interesting ideas come and go. Lots of thinking and discussing. More physics everywhere.

Dinners and ‘julefrokost’. Canteen packed with staff. Surprisingly, or not, no physics.

Axel Brandenburg, Germany, 1990-1992, assistant professor 1994-1996, professor 2000-

Astrophysics, Chaos, and Astrobiology

When my wife and I came from Helsinki to Copenhagen in 1990, we thoroughly enjoyed the relaxed Danish attitude to life, the mixture of people from diverse backgrounds at the Institute, and the openness towards new people. I have wonderful memories of my interactions with Mogens Jensen and Predrag Cvitanović and some of the many visitors such as Itamar Procaccia. This led to collaborations with people of very diverse backgrounds beyond my astrophysics training and was a tremendous enrichment for me and my future academic career. It also strengthened my case in getting afterwards a postdoc in Boulder and a chair in Newcastle upon Tyne, both of which, in turn, contributed to getting me back to Nordita. The time spans at different places were short, but always just long enough to accomplish something new. The exposure to open-minded people like Kari Enqvist and Poul Olesen was another such example that led to a new understanding of how primordial magnetic fields might have survived to the present day. I also benefited greatly from the interactions with other incoming postdocs such as Martin Nilsson Jacobi and Anja Andersen, which led to work in something completely different: astrobiology and the origin of life. These are all examples of the joint benefit of Nordita's role as a melting pot for science, which exceeds the sum of the benefits accomplished by individuals left in their original environments.

Vladimir Braun, Russia, assistant professor, 1995-1999

QCD and All That

The last time I was in Copenhagen, in October 2014, on the occasion of the christening of my third grandson, I could only stay through the weekend and had to hurry back home because my youngest son, born in 1996 in Frederiksberg, was turning eighteen and we wanted to have a decent celebration. This constellation of events gave a good opportunity to recollect my memories of the stay at Nordita many years ago.

My first attempt to visit Nordita was a failure: I did not realize that Denmark had not joined the Schengen agreement at that time, so I was not allowed to enter. The second time I was more careful, and, after surviving the interviews and the talks with members of the search committee, started to work as an assistant professor at Nordita on September 1, 1995. In retrospect, I believe that the working environment that I found and enjoyed at Nordita during the next three and a half years has been the best in my whole career. This has many aspects, starting from the general atmosphere that encouraged research, excellent administration and secretarial support, generous travel funds, many interesting visitors, and all these little things that are difficult to identify but at the end are decisive for what is called “corporate identity”.

I still remember the coffee breaks, small Danish flags on the cakes and even some jokes by Alan Luther. Before coming to Nordita I had had little exposure to condensed matter physicists and it was an interesting experience. I remember one of them (F.K.) asked me what is my field. I answered “QCD, Quantum Chromodynamics”. “Is this a gauge theory with a group $SU(3)$?” “Yes, exactly”. The next question was, “OK, and what else are you doing?”. Such encounters are important to understand that not only theoretical physics is broader than your own field (of course), but also that people may have a totally different ‘system of coordinates’ in what they find relevant.

More seriously, this also proved to be a successful period in my work. I wrote a couple of papers that I am proud of, and also started a collaboration that continues for twenty years now. Together with Paul Hoyer we organized a first workshop devoted to the so-called generalized parton distributions and it turned out to be instrumental for the acceptance of this topic by the hadron physics community.

I also enjoyed living in Copenhagen which reminds me, a little, of my home city, St. Petersburg. Finding an apartment for rent in Copenhagen

has always been difficult, and, combined with my incompetence in practical matters, resulted in our having to move very often, more than ten times during the 3.5 year period. On the positive side it gave us an opportunity to explore the city. Our son was born in Frederiksberg, and, after we left, my daughter decided to stay in Denmark for life. She graduated from the University, married, got her Ph.D, has had a steep career and gave us three grandchildren that I am very fond of. I always try to come to Blegdamsvej 17 when I am visiting them, and at home in Germany we are still using some plates and a salad bowl that Helle gave us as a present when we left, in February 1999.

In this short note I cannot mention all of my former Nordita colleagues and friends by name. I wish the best to all of them and believe that Nordita bonds will accompany us for the rest of our lives.

Georg Bruun, Denmark, 1999-2002

Working on Cold Atomic Gases at Nordita

My time as a Nordita fellow, 1999-2002, was a very inspiring and formative period in my career. This was due to several factors. As a fellow, I had no boss, which meant I was completely free to work on any problem of interest. The academic profile of the institute was furthermore broad with an excellent mix of permanent staff, fellows, and assistant professors from across the world, performing research in high energy, condensed matter, astro-, and nuclear physics. Being part of this mix helped me gain a broad research perspective and to build up a wide network of collaborators from which I still benefit to this day.

I was furthermore lucky that Nordita hosted a world-class research environment in my research field, which is cold atomic gases. This included Chris Pethick, Ben Mottelson, Gordon Baym, and Henrik Smith (Univ. of Copenhagen), as well as several fellows, students and regular visitors such as Georgios Kavoulakis, Luciano Viverit, Jens O. Andersen, Svante Jonsell, and Stephanie Reimann. We had weekly group meetings, and in addition to the many interesting physics discussions we had, I distinctly remember the excellent cake from the local bakery, usually bought by Chris or Henrik.

The social life among us fellows was quite active. We went out for dinners and drinks, and there was often lively discussions concerning the virtues and flaws of the various Scandinavian countries. I remember a Swedish fellow, who claimed that living in Denmark was like going back 20 years in time compared to Sweden! We also enjoyed the beautiful surroundings of the institute, taking walks in the adjacent park and visiting the many cafes along the lakes.

Each fellow at Nordita should give a 2-hour talk concerning his/her research for the whole institute. This was somewhat dreaded by us. For instance, Alan Luther had a knack of asking difficult questions, which had the potential to make you look foolish. We also wanted to impress the other fellows and the faculty, and as a result many of us made the mistake of highlighting the technical complexities of our research instead of the basic physics. Overall, it was however fun and interesting to learn what the other fellows were up to research-wise.

In total, I thoroughly enjoyed my time at Nordita. It was a very fruitful period where I broadened my academic profile and formed a network of collaborators, which I benefit from to this day. In my opinion, Nordita was highly successful in strengthening physics research across Scandinavia. This

is witnessed by the fact that many of its fellows today are lecturers/professors at various Nordic universities. It was in large part due to the free academic environment at the institute. This should be contrasted with the present tendency of politicians and funding agencies to give large sums of money to very specific research topics/groups, and the increasing demand of detailed planning and research ‘milestones’. The much freer spirit of Nordita was in my opinion a far better way to stimulate talents and good research!

Henrik Bruus, Denmark, 1990-92

Memories of a Condensed Matter Physicist

During the winter of 1989/90, I was writing my PhD thesis on experimental and theoretical aspects of the quantum Hall effect in a collaboration between Danish Fundamental Metrology and the Physics Laboratory, University of Copenhagen. My mind was set on becoming a postdoc somewhere in the US, so I wrote applications to a handful of prestigious American universities. My study buddy Michael Brix Pedersen advised me also to send an application to Nordita, and that I should do it right away, as the application deadline was the following day. At first, my attitude was that if I could not go to the US, then forget about a career in physics. However, I followed his advise, wrote an application to Nordita, biked the few hundred meters to Blegdamsvej, and dumped it in the Nordita mailbox the same night. Good advice indeed! I had no success with my US applications, but Nordita did offer me a postdoc fellowship to join the condensed matter group at the institute in September 1990.

I spent a couple of happy years at Nordita. The international level and atmosphere at Nordita transformed me and my view on how to practice theoretical physics. The influx of exciting visitors, the interesting seminars, and the lively group of fellow postdocs were all highly stimulating aspects, and on top of this, the possibility offered by Nordita to go abroad and attend international conferences was truly amazing and allowed me to create a scientific network of my own. The high level of the theoretical physics done at Nordita was paralleled by the high level of social life unfolding at the institute. The secretariat set the tone: While Helle Kiilerich and Ellen Pedersen were strict with us Fellows when it came to reports and our few other administrative tasks, they were always very friendly and encouraged us to engage in the various social activities at the institute, especially the three-o'clock tea break and the various parties. Personally, I had a lot of fun as party organizer together with the gang-of-three-Henriks (Henrik Svensmark, now professor at DTU Space, Henrik Jeldtoft Jensen, now professor at Imperial College London, and myself) and junior secretary Anne Lumholt. Another important part of the Nordita experience was the neighboring Fælledparken. How great it was to relax and let the thoughts flow with a leisurely walk in the beautiful park. In fact the park induced me to take up running at that time, and to such an extent that I ran my first marathon in Copenhagen in May 1992. The next day I had to travel to Helsinki with sore legs to participate in the Nordita Board Meeting as the representative of the postdoctoral

fellows. It is a testimony to the youthfulness of the not too young senior members of the board that I was the only participant entering the meeting with a limp.

I am grateful to Nordita's postdoc program for preparing me for a career as a theoretical physicist on international level. After my stay at Nordita I did manage to go to the US. I spent two and a half years as a postdoc at Yale University, followed by another 30 months as a postdoc at CNRS Grenoble, before I returned to Denmark to take up an associate professorship at the Niels Bohr Institute and later my current professorship at DTU.

Kari Enqvist, Finland, assistant professor, 1990-1994

Memories of an Astroparticle Physicist

I arrived in Copenhagen in the late June of 1990 as a fresh assistant professor. I had gotten my PhD in 1984 and then had served as a postdoc at CERN and in Madison, Wisconsin. Careerwise, this was definitely a move upwards. Stepping into the old Nordita building I was received with almost embarrassing enthusiasm; I felt that I had never been treated with more respect. I felt exalted. It seemed to me that I had passed over some invisible threshold and had finally arrived.

Life in Copenhagen was good. After a while I moved to an address which, although strictly speaking located in Frederiksberg, is the only appropriate one for a Finn: Suomisvej 1. I was very impressed by Auditorium A with the framed photograph hanging on the wall, depicting the past giants – Heisenberg, Pauli, the playful Gamow with a horn, and so on – in a meeting at the very same room. Which probably was the most uncomfortable lecture room in the whole of the Western world. Indeed, one felt that some sort of a glorious aura still lingered on at Nordita. To me, there was excitement but also some insularity. The professors were running their own fiefdoms and as an assistant professor, I had a distinct feeling that I was just passing through. Which of course is what I was expected to do. I have no complaints: Nordita gave my career a definite boost.

I had my own little group, including Kimmo Kainulainen as a fellow, who taught me bench pressing in a smelly basement in the Østerbro sports hall. However, at the social and sometimes also at the scientific level I tended to mix more with the people at the Niels Bohr Institute. In fact, my office was located in the NBI building. To me Nordita manifested itself as occasional meetings and parties, and of course as Helle, who, as far as I was concerned, was running the Institute.

I remember one Christmas party where somebody sitting at my table suddenly pulled out a pipe and, with no apologies, started puffing out enormous plumes of smoke – something that today would be considered unthinkable. I also remember one day, probably in 1992, when Jan Ambjørn wanted to show me something on his computer screen. It was a web browser, Netscape, with its comets flashing by as it was slowly connecting to the particle physics Arxiv database. Jan was claiming that this will be the future; I remained doubtful. The times were certainly changing.

All of this seems now like a very distant past, almost a different world. But I still recall with fondness the creaky, narrow stairs and the confusing

passages. Having to survive the current administrative culture with its many electronic forms, its rules and regulations, its checks and double checks, that seems to pervade all universities, I cannot but hark back to my days at Nordita. There administration meant Helle and her enormous safe. She took out cash and while I watched in silent fascination, she counted the money and, against my hasty signature, pushed the pile over to me.

Lisa Freyhult, Sweden, 2004-2006

Integrability, spin chains and AdS/CFT

The first time I visited Nordita was for a summer school intended for master students. I had just finished my second year at university and did not really have the right background to attend but somehow I had been accepted anyway. The school included lectures with Holger Bech Nielsen, Lene Hau and others. We had lectures on quantum gravity, which was great apart from it being totally incomprehensible for me as I had not even studied quantum mechanics by that time. I felt incredibly stupid for most parts of the school but I was intrigued and inspired to learn more.

After finishing my PhD some years later I came to Nordita for my first postdoc. I started working with Charlotte Kristjansen and Teresia Månsson on aspects of integrability in AdS/CFT. For me this was a great time, I met inspiring people at the institute and had many interesting discussions on all aspects of physics. Nordita collected theoretical physicists from several different fields and there were opportunities to naturally interact also with those not working in the same field. I particularly remember the Nordita seminars where different members presented their research to the others, and then we all had Danish pastry. The great thing with the people at Nordita was that we all sort of spoke the same language, all had very solid backgrounds in physics and mathematics, even though some worked on quite diverse subjects. This made discussions interesting and challenging. As I worked on integrable systems and spin chains it was very useful to talk to the people working on condensed matter physics who knew a lot about the systems we were studying in a completely different context.

The most important thing during my time at Nordita was the collaboration with people at the institute, it made work enjoyable and productive and made me want to continue working in theoretical physics. Then social life was of course important too, movie nights with the fellows, director's cookies, Kongens Have and the Botanical Garden with friends, excursions in and around Copenhagen, nice beaches in the summer and Danish class with Swedish people!

Johan Grundberg, Sweden, 1986-1988

Nordita 1986-1988

I defended my PhD thesis at Stockholm University in December 1985. About the same time I received word that I had been accepted as a Nordita fellow for two years starting in the autumn 1986, which relieved the immediate anxiety about what to do next. My thesis was on topics in supersymmetric field theory and supergravity and at this time a lot was happening in superstring theory. Maybe that was the direction to go in. I didn't know much about Nordita, but I knew that it was at the same place as the Niels Bohr Institute, and I was very much aware of the importance of contributions from Blegdamvej 17 in 20th century physics. I had been at a particle theory summer school in the early 1980s organized by Nordita, and I knew that some people who had contributed to string theory in its earlier phases were in Copenhagen. It seemed likely that it was going to be an interesting and stimulating place to spend a couple of years, and so it was.

During my stay in Copenhagen I lived in Nordisk Kollegium (where both breakfast and dinner was served, which simplified things). At the institute I shared an office with A. Tollstén, another Nordita fellow, and D. Rohrlich, a postdoc. As far as research goes, during the first year I made an attempt in the direction of string field theory. Together with A. Tollstén, I tried to understand some recent papers by W. Siegel and B. Zwiebach and to go beyond what was in them, but that didn't lead anywhere as far as publications go. The second year I collaborated with R. Nakayama, a postdoc who had worked on string theory, and we wrote a couple of papers that I view as among the best ones that I have been involved in, certainly better than any paper in my thesis.

There were many visitors to NBI/Nordita, often new faces at the coffee table in the morning, and many interesting seminars to go to. If something interesting happened in the world of physics, there were likely to be someone there who knew about it. Two things that stand out that generated discussions and seminars are the discovery of high-temperature superconductivity and the supernova 1987A. There were also some courses/series of lectures. The ones I remember I followed on a regular basis were J. Hertz on neural networks and C. Pethick and R. Svensson on astrophysics. The former stimulated me to improve my knowledge of statistical physics (which was close to nonexistent) and the notes I took in the latter were useful for me a few years later when I found myself teaching elementary astronomy. There is no doubt that my stay in Copenhagen broadened my view of what is interesting in physics, and I certainly had the opportunity to meet people, even if I should have made more use of it.

Ragnheidur Gudmundsdottir, Iceland, 1988-1989

Memories of a Fellow from Iceland

In the fall of 1988 I moved to Copenhagen with my 7 year old daughter Birgitta Sif to stay as a fellow at Nordita. The Institute arranged for us to rent a very nice apartment in Slagelsegade, just around the corner from the Niels Bohr Institute and Nordita. For me Copenhagen was charming. This was my first stay in the former capital of Iceland and it was wonderful to experience all the places one had just read about.

The Institute was in an old beautiful building with great history. On the walls of the lecture halls were pictures from probably the most interesting of times in physics, the extraordinary beginning of quantum theory. There in the pictures were all the great physicists sitting in those same lecture halls that we were at that time sitting in.

The community of postdocs/fellows was very international and so was the team of professors. We worked in wonderful old rooms with old chalkboards to discuss at. Then of course there was the cozy cafeteria where we would sometimes sit and talk. I remember the guy who served lunch in the cafeteria. He was wonderful. I did not understand much of what he said, but he was constantly singing Beatles songs while serving lunch. Behind the Institute was a wonderful large park where one could go for walks and talk. I also remember going out to dinner with the other fellows and visiting students and walking around in wonderful Copenhagen. I could not stay out late since I had Birgitta Sif with me, but she would go out to dinner with us. She loved it. I did not understand much Danish even though I had studied it in school for years. The community at Nordita was international, wider than nordic, so the language spoken there was English. I could understand Danish but only if it was spoken slowly. I am afraid it did not get better in those 10 months. During the 5 years that I spent in Sweden, my school Danish was taken over and turned into Swedish. This was a bit of a problem for me since I felt that if I was talking to a Danish person I should speak Danish. When I called up an institution for something, I would try to speak Danish but then they would pour over me a long speech in fast Danish that I did not understand and I was totally miserable. During the last few months of my stay there my fiancé came also to stay at the Institute as guest professor. After that, when I had to call someone on the phone I had him do it for me. He was American so he did not have to talk Danish like I felt I had to. We got married in the Rådhus of Copenhagen, in a group of many people also getting married in the wonderful Marriage Room they have there at the

Rådhus. We did not invite anyone to the wedding but to compensate we had our pictures taken by a fancy photographer (the royal photographer) that was recommended by the Institute and gave our families pictures. I moved after 10 months to the US with my husband and took a postdoc there.

All in all, the memories, now from almost 30 years ago are very warm. The time at Nordita was a lovely time. People were excited about string theory and all kinds of ideas were floating around. There were guest lecturers and the local people gave lectures, everything was interesting and exciting. There was even in the short time I was there a major conference where people from the East and the West came and gave talks along of course with the Europeans. It was an Institute that gave a lot to the physics community and was a great place that brought together physicists from all around the world.

Henning Heiselberg, Denmark, 1987-89 and assistant professor, 1995-2002

A Journey through Many Areas of Physics

Here is a short impression of my nine wonderful years at Nordita Copenhagen with special emphasis on some personal memorable moments: Nordita opened up to new exciting physics at international level in a wide range of disciplines that few of us had experienced at our local universities. The constant flux of fellows, assistant professors and visitors insured an atmosphere of innovation and new science. The institute was professionally guided by the staff including motherly secretaries. We were taught *par excellence* to attack new important problems in physics, write a short PRL when solved, and then to go on to a new problem. This was great fun and very rewarding but tough. Personally, I took a trip from nuclear physics (multifragmentation), to high energy heavy ion physics, QCD plasma physics and transport theory, astrophysics (neutron stars), and to ultracold atomic traps (BECs, superfluidity, unitarity).

International contacts led to other adventures. Chris Pethick recommended me for a postdoc in Urbana, Illinois, where we were known as Nordita boys - and later on as Urbana boys. Those were the days of Cold Fusion, and Gordon Baym would report fumingly from congressional hearings in DC. Gordon has a bunch of anecdotes and, if you get the chance, ask about Feynman's Oak Ridge blueprints. Whenever we saw John Bardeen in the corridor of Loomis Lab we would whisper: "Hush, he is working on his third". Back at Nordita we investigated a number of interesting problems. For months we tried to understand a 40-year old Letter by Gorkov on induced pairing. Chris even phoned him (in Russian) but all Gorkov could remember was "that it had been a very difficult problemski". It was very gratifying when we finally understood that leading log. At other times when faith faltered, Chris would pull down his bible - the Landau and Lifshitz series. Unfortunately for me, the letters were in Cyrillic. I wish I had been there when Hans Bethe snorted at Chris and Gordon, "I have fallen into a den of thermodynamicists!".

As Nordic Lecturer I had the pleasure to help organizing the Nuclear Winter schools in Gräftåvallen. These cold and dark experiences in early January were nice meetings both for the physics, the physical exercise on skis, snow scooter ice fishing, and driving snowmobiles up the mountain to snow caves, where we would grill Tjernobyl radioactive reindeer at night under the Northern Lights. It was also great fun to run the Nordita summer school for Nordic and Baltic students. It was surprisingly easy to get good

lecturers volunteering for free from various universities and industry. Finally, the “End of the World” afternoon arrangements with Holger Bech Nielsen on slapstick were very memorable and they attracted a full Auditorium A. As a member of the faculty I attended board meetings. Demonstrating activity and resolve, the board would always change a number of things, and then change it back a year later. For that reason the Faculty cleverly had more than one year implementation time.

In my last year at Nordita I finally got to work with Ben Mottelson. Not on nuclear physics but on superpairing in traps with ultracold Fermi atoms, which incidentally is a larger playground of nuclear physics. Ben amazed me every day by pulling 80 years of analytical tricks and sum rules out of his sleeve. Soon NBI started calling my office asking for Ben. We had good interaction with NBI on research as well as teaching. I lectured in the course on “Hot and Dense Matter” for nine years, and my sons tell me that my lecture notes are still in use. Yet the NBI support for Nordita dwindled and eventually led to Nordita’s demise in Copenhagen. Good days don’t last except in memories.

Morten Hjorth-Jensen, Norway, 1996-1998

Memories of a Weekly Commuter

I do not have so much to say because my family lived in Oslo, which meant that I sat on the night train or plane to Oslo every Friday and came back on Monday or Tuesday. As a weekly commuter, life in Copenhagen was mainly work, with little extracurricular activity. I think I was in the city center two or three times during the two years, and that was when my family came to visit. Anyway Copenhagen is well-known to most Norwegians!

I worked a lot with Henning Heiselberg, and we wrote several good scientific articles together. Unfortunately, nuclear physics was a field that was being cut back in my time at Nordita, and it was only Henning and I who did nuclear physics then. And I was probably a little more concerned with my own things to be conscious enough about the possibilities at Nordita/NBI to do other things (but it's not always as easy as post-doc). But I had from my student days a large international network, especially in the United States, and the time at Nordita was also used to strengthen that. I now work only 50% in Norway and the rest of the year I am in the US. My strong ties to the United States from my Nordita time and earlier have played an important role here.

My time in Copenhagen was also a time when the university there and thus NBI went through significant cutbacks, which marked the future prospects for nuclear physics. The only permanent employees in nuclear theory at NBI were Jakob Bondorf, who was almost retired when I arrived, and Thomas Døssing. I had a lot of contact with Carl Gaarde before I came, but unfortunately he died in 1998 after a long illness. And it was in the cards that the tandem lab at Risø was to be shut down. So, the time in Copenhagen I remember most as a time when I worked all the week, and then commuted back and forth to Oslo on the weekends.

I remember with joy Helle Kiilerich and her colleagues in the administration. This made my everyday life brighter and that is one of my best memories of the time at Nordita. It was always nice to meet and talk to you and your colleagues either over a cup of coffee or just for a chat.

Henrik Jeldtoft Jensen, Denmark, 1988-1991

Nordita 1988-92

To me Nordita was the materialisation of the academic ideal of an environment dedicated to creativity, curiosity and mind expansion. The focus was on ideas, preferentially new ideas and more or less everyone seemed to be welcomed and allowed to participate in the discussions. I spent four years between 1988 and 1992 in between a postdoc position at McMaster University and a position at Imperial College London (where I am still based).

I experienced total research freedom at Nordita and could enjoy with fellow researchers to spend time on projects of basic importance but not with any clear short term practical applications. Fundamental research was accepted to be of obvious importance and the spirit of the institution was in the great European academic tradition reaching about 900 years back, which assumes (in Pasteur's words) that "there is not such a thing as applied science, there is only applications of science". So best simply try to help to push back the boundary of our ignorance by choosing to do research in those areas where our lack of understanding scientifically appears to be the most troublesome.

Driven by this enthusiasm, Nordita managed, together with the intimately related Niels Bohr Institute, to be a home for innumerable trail blazing meetings, countless visiting scientists from around the globe, but especially in unusually large numbers from Russia, and the former Soviet Union, and a steady stream of Nordic physicists enjoying the buzz and the flow of latest scientific rumours, fashions, talking points etc. All around the world of physics, Nordita was seen as a watering hole worth visiting. Where one might chance meet famous physicists or, equally likely, strike up a new fruitful collaboration with some not very famous but nevertheless brilliant scientist.

All this was achieved on a very modest budget, but a budget used for doing science, rather than doing all the multiple distractions that commonly hinders thinking such as over bureaucratic administrating science, never ending report writing about what one has done and what one would like to do. The daily administration – handling zillions of visitors and the ever happening workshops, conferences, symposia etc. – was taken care of by a relative small number of highly competent secretaries. Their remarkable efficiency was related to many years of experience. The visitors, Nordita fellows, associated professors and even professors, came and left but the core of the

secretariat remained; persistently accumulating evermore expertise and invaluable knowledge about the international physics community and how to handle the scientific equivalence of a busy beehive.

It is difficult to imagine how the buzzing creativity could have been nursed in an environment that didn't still feel the vibrations of the excitement of the time when the Niels Bohr Institute was the world centre of theoretical physics. Every speaker in Auditorium A was reminded by the photos on the wall that on these benches, the great fathers of Quantum Mechanics had struggled with the conceptual puzzles and bewilderments forced upon us by the discoveries of the atomic world in early 1900. To lecture to a hall where the founders of our present scientific outlook used to meet was stimulating to a degree that is unquantifiable.

We Nordita fellows learned how to do science in these surroundings. Having discussions of our research with visiting greats such as Anatoly Larkin, Per Bak, Geoffrey Grinstein, Itamar Procaccia, Predrag Cvitanović and countless others from the international world of physics; for then over lunch to bump into personalities like Abraham Pais, Mitchell Feigenbaum, Vinay Ambegaokar to mention a few. In addition, there were the local stars Mogen Høgh Jensen, Kim Sneppen and Tomas Bohr, all three energetic and active at a terrific level, and there were the local Masters: the trio John Hertz, Alan Luther and Chris Pethick. All three very well known, very well connected, infinitely friendly and supportive and all passionate about their own research and science in general. With these and similar intellectual spectacles as the daily backdrop, it was easy to get encouraged to try to be daring and innovative and to get involved with new and open research areas.

These were the years of hectic research in all aspects of superconductivity and Self-Organised Criticality (SOC). High Temperature Superconductivity was discovered in 1986 and SOC suggested by Bak, Tang and Wiesenfeld in 1987. I had become involved in both research fields while still in Canada, but Nordita gave me the chance to many-double my learning and research. The contacts I made, and the strengthening of my research I received at Nordita was the most important reason I was able to move on and continue a research career at Imperial College in London. Imperial is a big international place, London and the south of England have perhaps the largest concentration of research institutions and universities in the world, but I don't know of any environment that really compares with the Nordita I experienced around 1990. The intensity and curiosity and daring inquisitive attitude with a focus on learning for the sake of learning was unique and very difficult to replicate.

Mogens H. Jensen, Denmark, assistant professor 1986-1993

Complex Systems: The Early Days

In the mid 1980s I worked as a postdoctoral fellow at the University of Chicago. I applied for various positions and was so lucky to receive an offer from Nordita for an assistant professorships in condensed matter/complex systems theory. It came just at the right time and I accepted with great pleasure. Both during my PhD and in particular at the University of Chicago, I had worked more and more on chaos, fractals and complex systems in general. It so happened that both Predrag Cvitanović (who had been assistant professor at Nordita) and Tomas Bohr were at the Niels Bohr Institute at the same time. We began to build up a group in this new and exciting field and got generous support from Nordita for our plans, both from the professor collegium and from the director at that time, Allan Mackintosh. In fact, Mackintosh had supported our effort quite a lot by being instrumental in promoting Tomas Bohr for a Hallas-Møller fellowship. I remember that he called me several times at the University of Chicago about the various perspectives for the upcoming job.

At Nordita I enjoyed the interactions with all the different Nordic institutions a lot. It was always a pleasure to visit, give talks and be thesis opponent in Norway, Sweden, Finland, and Iceland. The subtleties and differences in the culture between the Nordic countries have always interested me, and being at Nordita was the perfect position to dig deeper into the cultures around the scientific environments in the Nordic countries. Also, the interactions with the Nordic fellows were a great pleasure for me. To be honest, it took me some time to get a feel for the differences in their backgrounds – again the different cultures. I realized that students from Sweden often had a completely different profile in their educational background than say students from Finland. After some time I managed – the transition from being supervised to acting as a supervisor is not so easy! In the complex Nordita/NBI group we started arranging workshops and conferences with a lot of our colleagues coming from all over the world. These were great occasions where long term colleagues like Itamar Procaccia, Leo Kadanoff, Albert Liebchaber and Mitchell Feigenbaum came! I also with great pleasure remember several of the Copenhagen-Landau meetings, in particular one in summer of 1988 where people like Bardeen, Polyakov, Gross, Ginzburg, etc all came - a fantastic conference. From our local ‘complex systems’ viewpoint probably our summer schools were the most successful. Predrag Cvitanović had started them out at the coast of Skåne, in Yngsjö. I continued this

tradition and we had some fantastically inspiring schools here. Students from Nordic countries - and the rest of the world - were quite attracted to the chaos/complex systems field, which gave the schools a great 'pioneering' atmosphere with wild discussions and a nice social atmosphere.

Our common effort in this field came nicely together with the 'Center for Chaos and Turbulence Studies - CATS'. We attracted quite a lot of foreign students in the center and CATS continued for around 10 years. A few years later I initiated summer schools at Krogerup Højskole in Humlebæk. This turned out to be the ideal format for a summer school with the excellent surroundings close to the sea. Many Nordic students came to the first school in 1993 and they were quite excited about the topics and the social arrangements. In 1995 Kim Sneppen was hired as a Nordic lecturer at Nordita. Together he and I slowly moved our activity into more biologically oriented studies. Again Nordita was very supportive of our effort, both with workshops and guests. In 1995 we, together with John Hertz, arranged a summer school in Krogerup on topics in Biological Physics and a long list of the most prominent speakers came to this two weeks event.

Let me finally mention all the meetings with the Nordita Board. First of all I think they always took place in a very gentle atmosphere where all topics were discussed in a civilized way - always with an eye on how to promote the physics communities in the Nordic countries in the best possible ways. Next, it also gave contact to many of the Nordic groups as the board members changed and in this way gave the Nordita staff knowledge of basically any physics group in the five countries. This gave rise to many pleasant visits in the Nordic countries.

Lauri Jetsu, Finland, 1995-1997

Extracurricular Activities

My work at Nordita in Copenhagen differed from that in Helsinki. There was no bureaucracy or teaching duties, and I could concentrate only on research. My net salary in Nordita (1995-1997) was better than my net salary as the director of the Observatory of the University of Helsinki (2001-2009). We Finns spent a lot of spare time playing bridge (Mikko Alava, Janne Ignatius and Leo Kärkkäinen). The neighbour's cat frequently kept us company and I gave it snacks during those night time visits.



The name of neighbour's cat was 'Stockholm', but I called it 'Turri'.

Kimmo Kainulainen, Finland, 1990-1992 and assistant professor 1998-2001

Baryogenesis in the 1990s

Nordita in Copenhagen was a very special place for me. I went there for my first postdoc in 1990 and later I spent almost four years there as an assistant professor in 1998-2001. I still remember vividly how we first arrived to Copenhagen, our car filled with moving gear. Copenhagen looked just magical and we immediately fell in love with the city. The atmosphere in Nordita, hosted at the institute built by Bohr himself, was also something special. In the smell of the old house and books and paper, I thought I could still feel the presence of Bohr, Heisenberg and all the other giants that did great findings there in the early twentieth century. That gave a tremendous boost to the feeling of the importance of my own work as well. Another thing I fondly remember about Nordita was its friendly and helpful secretaries; super-efficient Helle of course, but also Anne, Jette, Anna Maria and others. It truly felt like a big family to me.

Being admitted to the Nordic fellowship program in Nordita was an excellent start for my postdoc career. I think that it is a pity and a mistake that Nordita currently has all but cut this program in favour of purely international candidates. A specific Nordic program led to life-long connections between Nordic institutes, with Nordita as the node, naturally through people. The same applies to the assistant professor program, even though my position in 1998 happened to be an international one.

One important aspect about the work at Nordita was organising meetings. It was all about being international, you see, and very useful as such. In particular I remember a neutrino-physics meeting I arranged with Kari Enqvist in 1991. Through this meeting I came to know Jim Cline, who later became my longest standing collaborator and a good friend. I also remember arranging a big conference on vacuum energy in 2000, upon a suggestion by Igor Novikov. It was one of the first major meetings on the subject, just a couple of years after the seminal finding of the accelerated expansion of the universe. I did not understand much about dark energy myself at the time, but one thing I remember of the conference was a picture shown by Joe Silk, indicating that the accepted value of the cosmological constant has had a period of about 15 years, oscillating between zero and one. If this trend was to hold, we should see the (next) demise of dark energy still before next X-mas! The topic of yet another meeting which I helped organising in 1991 was electroweak baryogenesis. I recall going to the airport to pick up a bunch of great Russian scientists, including the now famous

Misha Shaposhnikov and Vadim Kuzmin. Kuzmin then spent essentially all his time chain-smoking Russian cigarettes of questionable odour in the NBI-building staircase. In this meeting I also came to know Larry McLerran, from the Theoretical Physics Institute in Minneapolis, where I was to spend my next postdoc, hired by Keith Olive. What did I study there? Of course electroweak baryogenesis.

There is no way I could mention all the interesting people I met at Nordita. In the local staff, to which I happily mix the NBI-people, there was Paul Hoyer, Chris Pethick, Paolo Di Vecchia, Poul Olesen and Holger Bech Nielsen and Jan Ambjørn to look up. Also, by funny coincidence I was hired as an assistant professor at the same time as Kari Rummukainen, who comes from the same class in the same high school in the small backwater town of Nurmes in eastern Finland! So there we classmates sat in neighbouring hot offices on the third floor of the NBI building doing research – and occasionally watching live Sumo tournaments. (That was early times of the internet, so the picture would often freeze right after the tachiai, only to recover after the bout was over!) With Poul Damgaard I had one hilarious incident caused by my notoriously bad memory. We had had our offices opposite each other for three years, when one morning Poul, in his usual energetic fashion, rushed to my office and said “Kimmo, my computer is down. Can you download my last paper from the net for me”. “Sure”, I say, turn to my computer and start typing (Poul standing behind me): Find author . . .? Darn! I can’t remember his name! About ten or so stressful seconds later I had to tell him and, boy, did he have fun! Yes, life was eventful and fun at the good old Nordita and sometimes I miss it badly!

Alexander Kashlinsky, Israel, assistant professor 1994-1997

My years at Nordita, Copenhagen

I first discovered Nordita, the Niels Bohr Institute and Copenhagen in the Summer of 1989 when my old friend and colleague from Cambridge, Bernard Jones, invited me for a visit. Bernard was then Nordita's Assistant Professor in astrophysics. When I arrived, I discovered a highly interactive, and professionally fruitful, astrophysics environment consisting of Bernard and his cosmology students: Lone Appel, Fernando Atrio-Barandela, and Henrik Vedel. Roland Svensson was the Nordic Assistant Professor at the same time extending the scientific horizons to high-energy astrophysics. Later, they were joined by Jesper Sommer-Larsen, returning from Australia, and Per Lilje, arriving from Canada. I was very fortunate, and this visit has resulted in friendships and collaborations that endured to the present day. The relaxing and pleasant atmosphere I have discovered in 'Wonderful Copenhagen' likewise left a positive impression and I visited Copenhagen and Nordita/NBI for several more summers until I was offered and accepted an Assistant Professorship starting in Autumn 1994. Immediately after Bernard Jones, Marek Abramowicz became Nordita's Assistant Professor in Astrophysics and Igor Novikov moved to NBI/Nordita, opening the new Theoretical Astrophysics Center (TAC), thereby expanding research horizons to encompass general relativity and widening the pool of scientists working in astrophysics under the general Nordita/NBI/TAC umbrella. Bernard Pagel moved to Copenhagen around 1990 to become Nordita's Professor of Astrophysics, further broadening and deepening the areas of research and expertise. Thus in the 1990s Copenhagen became a very active and productive place in astrophysics and cosmology. I warmly remember these years, which for me lasted until 1998 when I chose to return to Goddard Space Flight Center to continue my work in the field of the cosmic infrared background, which I was just beginning to explore in those years, but which turned out later to be a rich trove of science.

I must emphasize that much critical help in running Nordita and its science has come from the unique secretarial staff led by Helle Kiilerich, and supported by the great work of Hanne Bergen, Anne Lumholdt, Jette Nielsen and others. They made the bureaucracy barely noticeable to me and resources seemingly plentiful for travel and meetings. I had then managed to travel as far as South Africa and Australia (not repeated since) and to organize my first large cosmology meeting 'From COBE to galaxy formation' in December 1997 bringing in the future Nobel laureate, John Mather. I

learnt a useful lesson when Helle insisted – and delivered – on running such a large meeting without charging any registration fees!

I must also remark on the very nice interactive science atmosphere in Nordita and NBI in those days. I greatly enjoyed my interactions with Alan Luther, John Hertz and Predrag Cvitanović, who at the time led the Center for Chaos and Turbulence Studies (CATS). At the time I was attempting to apply the Mellin transform techniques to the various problems of inversion in cosmology and Predrag and his Center's people were very useful in my tackling of this problem, which – alas – turned out to be unrealistic in precise cosmological applications.

I visited again – for just a few days – Copenhagen and NBI many years later, in 2013. I was visiting the Dark Cosmology Center, run very successfully by Jens Hjorth, another Nordita Fellow from the 1990s. Some things remained as before, but notably and noticeably Nordita had moved to Stockholm, NBI has occupied the old Nordita building and the place did not quite look the same to me. Nordita in Copenhagen has played a prominent role in the physics endeavors since its establishment and, after its move to Stockholm, I believe it will continue to do so for many years to come.

Jari Kinaret, Finland, 1992-1994

Recollections of a Fellow in Condensed Matter Physics

I don't quite know which memories I should pick from that era. In scientific terms, it was not a particularly successful period for me – in the area of condensed matter theory, the interaction between the fellows and the faculty left quite a bit to be desired after Antti-Pekka moved to DTU. I had the privilege of serving in the board for some time, which was something of an eye-opener to witness how realpolitik could influence decisions.

The institute buildings were nothing short of a maze. I think my first month there, I could only find my way to the lunch room through the basement, while another fellow could only find it by going outdoors. In a sense it reminded me of MIT's main building, which also offered countless possibilities to get lost and discover new shortcuts. I remember being surprised by the number of secretarial staff, and the informal way that the administration worked. If only we could clone Helle so that there was one at each institute in the Nordic countries!

Life outside the institute had its ups and downs, the main down being that, since my wife had a preliminary decision from the authorities that she would qualify for the expert tax status, her employer reduced her salary to a level that would result in the same take home pay as her Danish colleagues. Then the authorities reversed their decision so she had effectively worked for pennies, despite a PhD from a world leading university. Not Nordita's fault, but nevertheless part of the experience. I remember, and greatly appreciate, that Helle tried to help us, but there was nothing to be done. It must have taken her a decade to get over the humiliating experience: she felt cheated both by the State of Denmark and her employer - justifiably, I think.

The upside included some new friends, visits to the beaches in Tisvildeleje and Gilleleje, weekend visits at different bakeries and cafes, and the challenges of trying to figure out when the shops would be open and what different food items were called. I still think that estragon sounds more like hormone therapy than a spice. The language in general posed a challenge, and while I learned to understand Danish pretty well, speaking remained elusive. Our last months we lived at a place, the address of which I could only pronounce after two or three beers (Hvidovrevej in Rødovre). Culturally, I still have difficulty in believing that my wife's employer would deliver us 40 liters of beer for Christmas and another 40 liters for Easter, as a compensation against the hardship that the employees were no longer allowed to drink more than 7 beers per person during a working day - I expect that would not work in Finland or Sweden (in Norway, probably nobody can afford 40 liters of beer).

Henning Knutsen, Norway, visitor, 1986-1987

A Most Satisfying Year

9-13 September 1985 I had the pleasure to participate in a workshop in Trondheim. Bernard Jones from Nordita gave a series of beautiful lectures entitled ‘Cosmological models’. I had a nice talk with this friendly lecturer and he invited me to come and visit Nordita when I had the opportunity. That possibility came true during the winter holidays in the spring semester. That kind of vacation still existed at Stavanger College of Engineering in those days. Hence, I went to Copenhagen and was received by a charming secretary, Helle Kiilerich. She is the most efficient administrator I ever met. Before I left Norway I had just caught an irritating cold. However, I still remember that in spite of a dripping nose, I found an elegant proof during that stay of the following fact concerning relativistic spheres: ‘For gaseous spheres with negative density gradient it is necessary and sufficient to have $v' > 0$ to have a negative pressure gradient and thus a positive pressure’, (Physica Scripta **35**, 238-242, 1987). The time of this visit is easy to ascertain. The morning I left for Stavanger I heard over the radio at the hotel that Sweden’s prime minister Olof Palme had been shot dead the previous afternoon.

For me what was most important was my meeting with Nils Robert Nilsson at Nordita. He was the editor of Physica Scripta. I had already published several papers in that journal. He advised me to apply to Nordita for a grant to stay there for the coming academic year 1986-1987. Nordita even supported my participation at the 11th International Conference on General Relativity and Gravitation which took place in Stockholm, July 6-12, 1986. The talk I gave there was later published in the International Journal of Theoretical Physics. My stay at Nordita was a golden opportunity to concentrate on scientific ideas and problems. The teaching duties at the engineering colleges were quite heavy at that time (at least 16 hours a week). I wrote five papers during my stay at Nordita, two on time dependent solutions of Einstein’s field equations and three on static relativistic spherically symmetric solutions. The atmosphere at the institute was especially cosy. We had lunch each day in the canteen with humorous chatting. There were always the most interesting scientific talks. I gave a lecture entitled ‘Average density in cosmology’ at a seminar. There were Bernard Jones and his eager students. There were my roommates Gunnlaugur Björnsson from Iceland and Karl Donner from Finland. There came the now late Roland Svensson from Sweden and there was Chris Pethick always just smiles. I

learnt to know several of the people who visited Nordita during my stay. Jaan Einasto from Estonia was there, and also Erlend Østgaard whom I had first met in Trondheim. We became very close friends.

I participated in three different conferences abroad during my stay at Nordita. The first was The 13th Texas Symposium on Relativistic Astrophysics in Chicago 14-19 December 1986. This was my first visit to USA, and I was quite overwhelmed by the size of the skyscrapers and visited the top of the Sears Tower. I was happy that my now late friend Sjur Refsdal was there. But coming back to Copenhagen I was struck by the small doll houses of that town. My second conference was 16th Jenaer Relativitätstheorie seminar, Georgenthal, DDR, 22-27 April, 1987. I gave a talk there: 'On some physical properties and the stability of an exact model for a relativistic star'. My third conference was exotic - I participated at a summer school on gravitation and cosmology 20-31 July in Rio de Janeiro. I learnt no samba, but impressive science.

One major event during my stay was the supernova which was discovered the night between 23 and 24 February 1987. This I first heard over the radio in the morning when I sat in our kitchen just before leaving for the institute. I rode my bike almost intoxicated from the excitement. I immediately wrote a proper popular article on this phenomenon. My article was promptly published in the Norwegian journal 'Naturen'.

My family was with me in Copenhagen. Nordita obtained a nice apartment for us. We were lucky that our son, Frode, got a place in a kindergarten. This gave my wife, Anja, plenty of time to study on her own. In the spring of 1987 she went back to Norway and passed her exams with splendid results. We also had our bicycles with us from Norway, and most weekends we took the opportunity to see interesting things in Copenhagen. Moreover, we often travelled long trips with our car and visited those towns which could be easily reached. We even enjoyed our summer holidays in Denmark and crossed the water to explore Jutland and Fyn. How nice it was to see the places connected to the novels by B. S. Ingemann I had read when I was a boy! In this country I obtained the proper editions of these books. In fact I found many hard to get books in the Danish antiquarian bookstores. I still enjoy reading them.

Taken into consideration the enormous amount of impressions of science and culture during this stay, I have no doubt: *This was our finest hour.*

Charlotte Kristjansen, Denmark, 1993-1997, assistant professor 2004-2006

How Nordita has Furthered my Career

The existence of Nordita has been essential for my career. Nordita offered me my first postdoctoral position in 1993 and even allowed me to take a two year break in this appointment to work at Service de Physique Théorique de Saclay in Paris. Later in 2003, Nordita made it possible for me to return to Denmark after a long term stay at the Max Planck Institute for Gravitational Physics in Potsdam by offering me a 3+3 year appointment as Nordic Lecturer. This appointment became my stepping stone to a permanent position at the Niels Bohr Institute in Copenhagen where I am now a full professor.

In recent years I have benefited greatly from (and also enthusiastically contributed to) the numerous interesting international programs which have taken place at Nordita in Stockholm.

Maarit Käpylä, Finland, 2004-2005

Astrophysics and Astrobiology

I was a Nordita fellow in Blegdamsvej 17 during 2004-2005. That was my second postdoctoral research post, having spent three years at the Laboratoire d'Astrophysique, Observatoire de Midi-Pyrénées, in Toulouse, with a grant from the Academy of Finland. To take up a position at Nordita was a hard choice, as I was also offered another position in the American Museum of Natural History, which I turned down with great regret due to my small children (Toivo, then 5 years; Aino, then 1.5 years, and Lauri who was born in Copenhagen). On the other hand, I was to work with Professor Axel Brandenburg, my PhD supervisor, with whom it had been a great pleasure to collaborate while he was a professor in Newcastle, and I was a visiting Ph.D. student from Oulu University, Finland. For the year that was meant to be my first year as a Nordita fellow, Axel was, however, in Cambridge for half a year, but I truly enjoyed the peace and quiet to think and work in my lovely attic office. Later on I learned that it had also been the office of many other Finnish Nordita fellows/assistant professors, including Lauri Jetsu.

This was the time when Axel had his interest devoted to astrobiology, and therefore I also participated in organizing the Nordita winter school in Levi about astrochemistry - I never had time to do any research on the topic, however, as I applied for the post of Academy Research Fellow in the September 2004 call, and was lucky to get selected for the post. Therefore, my stay in Copenhagen became shorter than expected. During that time, and ever since, however, I together with my research group have shared very close ties with Axel's group, and done some extremely important science on solar dynamo theory especially - at least I tend to think so myself. As for so many other Finnish and Nordic theoretical astrophysicists, Nordita has offered me a way to mature and excel in science. I hope this very special role of Nordita for Nordic researchers is acknowledged and strongly supported in the future also by all the Nordic countries, and that other universities in addition to Stockholm and Copenhagen will also see as beneficial to contribute to the funding of Nordita in the future. The modern Nordita with program and workshop activity continues to give strong support to the research I do in the framework of the first Academy of Finland Centre of Excellence in astronomy and space physics, which I hope will continue at least as actively as it does today.

What I did NOT learn to do while at Nordita was to eat the wienerbrød that was served at the beginning of the seminars - they tasted good, but made too big a mess. Luckily this is not a skill that is absolutely vital in life!

Per Lilje, Norway, 1989-1992

Three Years as a Nordita Astrophysics Fellow

I came to Nordita as a Nordita fellow in September 1989, and left for a permanent faculty position at the University of Oslo in August 1992. However, I had then already known Nordita for some years, first through the Nordita summer schools on astrophysics in Skutskär, Sweden, in 1982 and in Skibotn, Norway, in 1984. Through these, I got to know other Nordic astrophysics students, and especially got into contact with Bernard Jones, who was Assistant Professor at Nordita from 1982/83. Bernard proposed the theme for my masters thesis at the University of Oslo and was external supervisor for it 1983-84. Nordita graciously funded multiple travels for me to Copenhagen to get excellent supervision from Bernard, something which made it possible for me to get into state-of-the-art cosmology and large scale structure research as a masters student in Norway. Bernard was also instrumental in getting me to take the next step, as PhD student at the University of Cambridge, January 1985 - January 1988. During my first postdoc position at CITA, Toronto, I also spent a very fruitful and pleasant spring in 1988 as a guest researcher at Nordita. It was therefore really a coming back when I arrived at Nordita on September 1, 1989.

When I arrived, Bernard was away on sabbatical, and thereafter had the terrible experience of losing his daughter to cancer. I therefore did not have the chance to cooperate scientifically with Bernard during my time as Nordita Fellow. The late Roland Svensson was also assistant professor in astrophysics at Nordita, and one of my best memories is from the Nordita Summer School on Cosmology which Roland, Jes Madsen and I led at Gräftåvallen, Sweden, in 1990. Roland's untimely death in 2003 was a great loss to Nordic astrophysics. Also my last summer at Nordita, I led a Nordita Summer School, this time on "Galaxies: Structure, Formation and Evolution". My co-leaders were Bernard Pagel from Nordita and Jesper Sommer-Larsen from the Niels Bohr Institute. And this brings me to Bernard Pagel, who came to Nordita as a professor of astrophysics in 1990, some months after I had arrived. He was a most gentle personality, and with deep and broad knowledge and understanding of all of astrophysics, a true leader of the astrophysics group.

This was before the different physics departments had been put together into NBIfAFG (today NBI). Most astronomy at the University of Copenhagen was at the Astronomical Observatory (which was split between the old observatory building on the Østervold and Brorfelde near Holbæk), but

there was also a small astrophysics group at the ‘old’ Niels Bohr Institute. Bernard brought this group in closer contact with Nordita astrophysicists by moving us together in what was called the ‘astrophysics villa’ which became a very fruitful and lively place (earlier most of cosmology had been organised around Bernard Jones’s office in the basement of the Nordita building). Among the Nordita astrophysics fellows at that time was Axel Brandenburg who since 2000 has been professor of Astrophysics at Nordita, both in Copenhagen and in Stockholm. In addition to Bernard Pagel, the Nordita professors at that time included Chris Pethick, Ben Mottelson, Alan Luther, John Hertz and Paolo Di Vecchia.

Both the initiation to cosmology I received from Nordita as an M.Sc. student in Norway and especially my time as a Nordita Fellow were of course instrumental in securing a career as a professor of astrophysics in a Nordic country. Nordita was extremely successful for me, and for many others, I believe, as a ‘half way house’ between a PhD and a time as postdoc outside the Nordic countries and a faculty position ‘at home’. It gave me contacts and friends among Nordic astrophysicists and physicists which have been most important later.

If I should give any advice to present day Nordita, it must be to concentrate on the Nordic role without renouncing scientific excellence: Bring together young Nordic physicists with the internationally best, and especially give priority to those who will have a good probability of ending up in a faculty position in a university in one of the Nordic countries. The Nordita Fellowship programme (with priority to candidates from, or with strong connection, to a Nordic country) was excellent for that purpose. Also, my experience was that summer schools for Nordic masters and PhD students was an excellent way of not only teaching physics, but also to bring Nordic ‘brotherhood’ among scientists.

Finally, our three years in Copenhagen were most important for a young family. When my wife and I arrived on September 1, 1989, we had a 3 year old daughter and a 1 year old son, who had their next three years living in Østerbro and going to Danish kindergartens (our oldest daughter returned to Copenhagen at the age of 20 and has lived there since). And our youngest daughter was born in Copenhagen, six months before my time at Nordita was over. My wife got a job as clinical dietician at Bispebjerg Hospital, through which she got to know Danish clinical dieticians, something which has been important in her later career in Norway.

Kristian Lindgren, Sweden, 1989-1991

**A Postdoc Period at Nordita that Planted Several Seeds for
Research Directions in Complex Systems**

Finding a postdoc position that fits the constraints of interesting research areas, having a full time working wife and two small children back in Gothenburg, and the desire for a place with an interesting environment is not an easy task. The last point includes both the people at the institute and surrounding city life. Nordita turned up as the perfect possibility. With my wife's support, I decided to accept the offer since a four-day work week gave me three full days at home in Gothenburg every week. I had already an on-going collaboration with Mats Nordahl who had arrived as a postdoc a year earlier, and several other of the postdocs were doing research in what today could be called 'complex systems'. With the addition of several senior researchers at Nordita and the Niels Bohr Institute, this formed an inspiring research environment that really helped in developing ideas in two key areas for my later research in complex systems: computation and information theory for cellular automata and evolutionary game theory. I really enjoyed sitting in one of the tiniest rooms in the attic, sharing that with Mats, and two computers; one being one of the first parallel CPU desktop machines. A lot of work in the evenings at Nordita, and sleeping in the mornings on a sofa at Gunnar Russberg's apartment, another of the complex systems postdocs at that time.

After a year, and a couple of new papers in these areas, Nordita allowed me to spend a semester at the Santa Fe Institute, that added even more research contacts and new inspiration for research in complex systems. With my wife, I had now gotten a third child, and it was too complicated to go on with the weekly travelling after the US visit, so I had to end the postdoc period at Nordita after only a year and a half. The long term collaboration that was established with Mats Nordahl thanks to this postdoc period was crucial for the later establishment of complex systems at Chalmers in Gothenburg. Within a decade Mats and I had started both an international masters programme and a PhD education in complex systems. The two-year masters programme that is now in its 15th year attracted in 2015 more than 50 students from all over the world, with students from physics being the largest group.

Leif Lönnblad, Sweden, 1995-1997

A Fellow Commuting from Malmö

I came to Nordita as a fellow in 1995 after four years of postdocs at DESY and CERN, and it was like coming home. Quite literally coming home since, although the bridge across the strait of Øresund had not yet been completed, I was able to live in my home town, Malmö. This, of course, meant that I had to commute two and a half hours each day, mainly by the high-speed catamaran service. But it was actually not as tedious as it sounds – commuting by boat is quite relaxing, and you have lots of time reading new preprints and stuff. The bridge was actually already under construction during my time at Nordita, and it is interesting to note that my Danish colleagues around the coffee table mostly referred to it as ‘your’ bridge, as if they really couldn’t see any reason for any Dane ever wanting to travel across it to Malmö. I guess they were right in some sense, but the fact is that nowadays there is quite a large number of Danes who have moved to the Swedish side both because of lower housing prices and because of idiotic Danish immigration laws for foreigners marrying Danes.

Working at Nordita was really nice. As a postdoc you could in principle do whatever you wanted. Of course, there was some underlying pressure to publish enough papers to get another job afterwards, but there really wasn’t many other obligations preventing you from freely pursuing research of your own choice. This is, of course, something I really miss nowadays when I’m the head of our department in Lund, with an administrative load beyond belief. Also, the atmosphere at the institute was really nice and laid back, and cosy with the old corridors, historic seminar rooms and weird stair cases. Not least the administration was great. As an example, settling travel expenses typically consisted of taking your receipts to Helle, who would simply open the safe and give you cash.

During my time in Copenhagen I also got my first insights into how a research institution is managed when I served as a fellows’ representative on the Nordita board. One of my most interesting experiences there was when a new five-year staff position was to be filled. The short list was headed by a very well merited Russian, but some board members promoted the second guy on the list, arguing that there was already a couple Russians on the staff and hiring another would give to much of an imbalance. However, no one argued for promoting the only woman on the short list, even though at the time there was not a single female among the scientific staff. I guess much has changed since then, and today Nordita even has a female director. Since

I finished my postdoc period I have been back for visits many times. But now Nordita has gone to Stockholm, and I was really sad to see it leave. The buildings and NBI is of course still there, and I do visit there every now and then. And I'm sure the institute is doing a good job in Stockholm. But to me, Nordita will always mean Copenhagen and Blegdamsvej, and the time I spent there.

Anne Lumholdt, Denmark, secretary 1989-2005

A View from the Administration

When Helle asked me to contribute to this book a lot of memories came to my mind. I was very young, only 21, when I started at Nordita in the summer of 1989, and although not without working experience, it was a new world to me. The world of theoretical physics. A world I came to enjoy working in immensely and even miss today.

One of the things I have been thinking about is the number of different nationalities I have met during the years. People from: Argentina, Australia, Austria, Bangladesh, Belgium, Canada, Chile, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Latvia, Lithuania, The Netherlands, Norway, P.R. China, Poland, Russia, Spain, Sweden, Turkey, Ukraine and the UK, 32 nationalities in total; please forgive me if some have been left out.

During my time at Nordita we had 150-200 visitors per year. I know, since I made the list of visitors every year. Lets say 175 on average (excluding participants in schools/workshops/conferences/symposia) and in my 16 years the result is 2800 people. Wow. What a privilege to have met so many different people. Spending time with so many different nationalities sure broadens ones horizon. This, I think, is very healthy. I have answered many questions about Denmark and seeing my country from other people's perspective was quite interesting.

Another thing I came to think about, is the Nordita Master Class in Physics. Professor Sven Åberg from Lund and I, together with other people, co-arranged the first three. Meeting the young people and watching them receiving, as we say in Danish, a vitamin-injection to continue their further studies by meeting the inspiring first class researchers, was also an inspiration to me. And it was so nice that several of the students later came to Nordita as postdocs.

Today I am at my second job since leaving Nordita, working in a completely different environment as an administrator at the national Danish Accreditation Body, DANAK. Still occasionally meeting physicists, who always know someone I know. And I still keep in touch with a few people from my time at Nordita.

Anupam Mazumdar, India, assistant professor 2004-2007

Memories of an Astroparticle Physicist

I had spent less than three years in Nordita, Copenhagen, during the 2004-2007 academic years. I believe Nordita has definitely provided me the career I wanted, and it has shaped my own way of thinking interdisciplinary problems in physics and cosmology. I was very much influenced by the existing members of Nordita at that time, such as Chris Pethick, Axel Brandenburg, Dmitri Diakanov, and Paolo Di Vecchia, as well as numerous interactions I had with visitors. All have helped me to think about the nature of fundamental problems in gravity in a slightly different way. I recall vividly discussing some aspects of conformal gravity with Dmitri in our common room; this has led to my own works on resolving cosmological and blackhole singularities by extending Einstein gravity to a non-local theory of gravity in the ultraviolet, ideas which I am still pursuing.

Nordita in a true sense was a scientific adventure, which I cherish and will always hold a special place in my heart.

Ralf Metzler, Israel, assistant professor, 2002-2006

Recollections of a Biophysicist

My time at Nordita was probably the best time in my life. I was sitting, outsourced, in the C (library) building, in what people called the “Heisenberg room”, a small closet next to the full bathroom in the attic of the building. My office now is almost infinitely bigger, but I still miss the small old Nordita room with the view of Blegdamsvej, of the phallic symbol in the front yard. The view of the Danish summer sun and the street lamps switching on early on a winter day.

It was the period when I tried to find my own way in science as an international assistant professor at Nordita. Finding new topics to work on, and finding my way towards leading a, then small, group. I often felt uneasy about the future. In particular, when our first daughter was born and the Nordita secretaries looked into the baby pram. But it turned out to be the perfect place to find my way and be prepared for the future career.

And what a time it was: no heavy administration or bureaucratic rules, travel reimbursement straight in cash from Helle’s safe (den gamle Franz Jäger?). The coffee breaks, the warm and still extremely professional atmosphere. A lot of this, maybe most, was fully due to the secretaries. Helle, of course, and, for me, Ellen. And Anne, Hanne, and Anna Maria.

I remember the lunches in the NBI canteen, where the chef, Michael, always found something to eat even after the official closing time. Then there was, however, this period with too much biksebad. I remember taking my little group to the lakes for a pizza, that we grabbed from the Kurdish pizza place at Trianglen. And those wimpy Scandinavians complaining about the chill in winter all the time.

And yes, the most beautiful fact from those days: they all made a good career. Audun Bakk, now senior scientist at SINTEF, Trondheim; Tobias Ambjörnsson, associate professor at Lunds Universitet; Suman Banik, associate professor at the Bose Institute, Kolkata; Michael Lomholt, associate professor at Syddansk Universitet, Odense.

Much more than then Denmark and its culture is deeply engraved in my heart. I learned to love the language and its nice quirks. I miss the visits of Hans Fogedby from Aarhus and the finale of these evenings at Hviids Vinstue on Kongens Nytorv, Hans with a cigar. And walking through København late at night back to our home on Livjærgade afterwards.

In that sense Nordita was a beautiful blend of serious science and relaxed Danish lifestyle. A blend of bright ideas and low-watt light bulbs, of young-

sters like me and the almost humbling-yet-charming presence of the grand old colleagues, foremost Ben Mottelson and Aage Bohr. There is not a week during which I didn't wish I could be back there — ah, what a great time it was!

Jette Nielsen, Denmark, secretary, 1989-2003

Memories of a Secretary for Fourteen Years

My time as a Nordita secretary started some 26 years ago in 1989 and lasted for approximately 14 years. As a young bachelor with an almost newly acquired language degree in English and French from Copenhagen Business School, Nordita offered me an inspiring and international work environment. Thinking back, it is clear to me that there were some obvious reasons that motivated me to keep on working there so long, 14 years.

One factor was the lovely inspiring international research environment that brought more than around 100 visitors from all over the world to our institute. The many international visitors combined with the inquisitive mind-set of the Nordita physics research community, provided a stimulating forum for discussion not limited to the subject of physics, but also open to more worldly matters such as the political situation in Georgia, especially in the two daily coffee breaks held in the coffee room where everybody was welcome. As I write some funny memories from gatherings in the coffee room surface to my conscious mind. One such memory includes the story of how the world renowned Professor Holger Bech Nielsen had to seek assistance from the institute secretaries to sew buttons on his pants before a seminar or how a Norwegian professor used hair pins to keep his long hair in place. This stimulating forum for discussion and the openness I met there I have not found in many of my later workplaces.

This warm and internationally inspiring atmosphere was also present at the many large conferences and symposia held at Nordita. Not to forget the many conference dinners, Christmas dinners and institute parties. Nordita was in particular famous for the 'potluck' concept where every employee would bring a dish from their own country, thus creating a festive international food table at institute parties. On a personal level meeting these many different citizens, shaped my outlook on the world and has been an influential factor in me feeling more like a world citizen than a Dane. It has also provided me with a profound openness to multiculturalism and taught me that Nobel prize winners are human like everybody else. Last but not least I gained many lovely friendships.

Some other factors contributing to the long duration of my Nordita employment was the English speaking environment I as a language person was put in, the office technology I used and the diversity of my work tasks over the years. I remember my early days at Nordita distinctively. I remember being introduced to the new wonders of technology, the Vax, that helped me

send the manuscripts I had typed for a scientist across the Atlantic to an American scientist in a split second. This was in 1989 only some 26 years ago. Looking back over the 26 years it is incredible to think about how this Vax wonder from my early work days at Nordita has been replaced by Microsoft computers, internet, iPads and mobile phones etc. A technological development that none of us imagined then. I also remember one of my early tasks at Nordita was to send the many preprints and articles written by the scientists out to long standard lists with scientists all over the world by normal mail, i.e., piles of envelopes meaning several boxes with thick letters, something which was rapidly replaced by preprint databases as the IT technology rapidly advanced like a rocket. I cannot help comparing the internet/computer to the invention of the combustion engine in the early 1900s.

The language factor, the fact that often my daily work would involve speaking English to scientists, has without doubt influenced my ability to switch from Danish to English with ease, write in English and this has been and still is a valuable asset to my career till this day. Not least the diversity of the many tasks I had at Nordita paved the way for me coping with ease with a wide variety of administrative procedures in later jobs. My encounter with Nordita has proven to be a valuable friendship for me in my whole career, providing me with a great knowledge of the human nature and a solid language and administrative experience that I have drawn on and added to ever since.

I will end my tale with a curious anecdote that I remember from my first days at Nordita, I was jokingly told that I was hired because I wore such a nice pair of beige trousers at my job interview. If true it is funny to think how a pair of pants created so much good in my life and got me on the right track after having experienced the high unemployment in Denmark in the 1980s.

Kjell Olofsson, Sweden, 1988-1990

The Spectra of Starburst Galaxies

The Nordita fellowship gave me the opportunity to develop a computer code aimed at the study of the chemical evolution of starburst galaxies. This was very valuable when returning to Uppsala where I continued in the same field, including the spectral evolution of the same type of object. Besides that I have supervised undergraduate and graduate students. For a decade or so I have mostly been devoting my time to lecturing and dealing with educational issues, e.g., I served as director of education at our department for 14 years.

Rachid Ouyed, Canada, assistant professor, 1999-2002

Compact Stars and Biking from Amager

From the scientific point of view, Nordita allowed me to ‘push the envelope’ so to speak and work on novel ideas such as the Quark-Nova (<http://www.quarknova.ca>). Nordita supported me in my vision of ‘Compact Stars in the QCD Phase Diagram’ (CSQCD) meetings that has now evolved into an internationally recognized series with its own proceedings (<http://www.quarknova.ca/CSQCD.html>). I attach one of the most memorable (for me) pictures I have taken at Nordita from the first CSQCD meeting ever.



Holger Bech Nielsen and Rachid Ouyed

I remember the long hard working days at the institute which always led to excursions to Blegdammens Stjerne just down the road to drink the best beer in the world, Rød Tuborg (I was sad when they stopped making it). We sometimes went to the Chinese place on Triangeln, and other times we’d go down to Skt. Hans Torv. The bar I remember well is ‘Understellet’ where I had my best ideas after a few pints of great Danish beers. My favourite

moments were discussing physics with Alan Luther (who had the weirdest but yet incredible sense of humor). I never thought I would learn so much about electrons.

I lived on Amager (I was told it's too close to Sweden; Danish humor). I saw the Swedes come to Copenhagen with their Volvos and go back their Oelvo (sometimes they would drink their beer before they got to Sweden :-)). I truly enjoyed living in Copenhagen and working at Nordita, riding my bike from Amager to Nordita on a rainy day (how I miss that!). As for my overall experience living in Denmark, I learned that if you drink Gammel Dansk every day (which I did) you are in! If you can say "rødgrød med fløde" Danish girls pay attention to you regardless of your looks and accents (it worked for me since that's how I met my Danish girlfriend :-)!). I found the Danes to be very friendly and helpful. In their eyes they have the blue they are missing in the sky and their warmth makes for cosy winters (the word 'hygge' is truly unique to Danes). They are easy going and love life and a Danish friend of mine used to say: "In Denmark, if you are riding your bike against the wind then you are going the wrong way—"

Paolo Sibani, Denmark, 1983-1986

Memories of a Danish Fellow from Odense

After getting my master's degree in physics at the then Odense University in 1980, I was first awarded a three year research position as "kandidatstipendiat" at the same place, and then a Nordita stipend in Copenhagen, from 1983 to 1986. At the time I already had a wife, a small child and a house in Odense, and to balance work and family life I managed to spend three days a week in Copenhagen, and two days in Odense, where I kept a small office at the university. Nonetheless, my wife felt that I worked all the time. While in the Copenhagen area, I lived in Gentofte and bicycled back and forth from work. Sometimes I walked to the train station, took the train to Nordhavn, and then walked to Blegdamsvej. No matter what, it always took me one hour each way, and four hours from my Odense home to my Nordita desk. Denmark was clearly much bigger at the time.

At Nordita, I had a small office upstairs. The first striking thing I noticed were the weird panel displays blinking on the walls. These, I learned, were NBI devices meant to inform important people in the building that somebody wanted to get in touch with them. If you were one of these people, you could call your secretary and get further details.

Nordita had a very inspiring, informal and pleasant atmosphere. I mainly worked with John Hertz, who introduced me to spin glasses and started my interest for statistical physics and complex systems, an interest which I have kept through my working life. We young researchers were totally unencumbered by administrative hassles and could easily travel the world, when needed. In this way I started international collaborations still active today, some of which have evolved into personal friendships. Last but not least, I have established collaborations with other former Nordita students. What I valued most at Nordita were the high standards 'in the air', the international outlook, and the dedication of both scientific and administrative staff. My short years there had a decisive influence on both my professional development and my scientific interests later in life.

Ingve Simonsen, Norway, 2000-2002

From Statistical Optics to Complex Systems

I arrived at Nordita as a Nordic fellow (“stipendiat”) in October 2000, and I worked there the following two years. A few months prior to my arrival in Copenhagen, I had defended my PhD on statistical optics. Therefore, the period at Nordita marked my first real postdoc position even if I had held a research position at University of California, Irvine, half a year before, and a few months after, obtaining my doctorate. Moreover, at the end of 2005, on my way from industry back to academia, I spent a few more months at Nordita.

When I arrived in Copenhagen to take up my postdoc position, the institute was not entirely new to me. Actually, I first learned about Nordita while being a master student and working on high energy physics. The institute organized numerous Master Classes and summer schools for Nordic and Baltic master students, several of which I attended. Some of the events took place outside Denmark, but most outside Copenhagen or at Blegdamsvej where Nordita and NBI were located. I vividly remember a summer school on supersymmetry and superstring theory held at Blegdamsvej in the mid-1990s (if I remember correctly). Nordita Prof. Paolo Di Vecchia organized the school, gave most of the lectures, and even took part in the football matches in Fælledparken in the late afternoons; by the end of the week long school, Paolo almost lost his voice — no wonder! This is only one, of many, good and inspiring memories I have from such events that were so stimulating, motivating and rewarding for master students considering a potential future in research. It was partly due to such experiences that I was led to apply for a postdoc position at Nordita.

Soon after arriving at Nordita you noticed the friendly and open-minded atmosphere that existed at the institute and the low level of bureaucracy used for administrative matters; at least, these were my first observations. As a newly hired postdoc at Nordita, I intended to start working on “econophysics” which at the time was a fairly new field in physics, and an entirely new field to me that I gradually had become interested in. Here one applies the methods of physics to economics with the aim of being able to uncover the complex interplay between the market players and the market itself, social aspects, etc., and how those influence stock prices and trading volumes. Now looking back upon the time at Nordita, I can say that this institute was a good place to start working in a new and interdisciplinary field. Never did I hear statements like “This is not physics!” which I know colleagues

elsewhere were told by some of their less open-minded colleagues. Instead many colleagues at both Nordita and NBI were curious and interested in what econophysics was all about. I ended up working closely with Mogens Høgh Jensen and Kim Sneppen on physics of complex systems (including econophysics), and I remain in contact with them. Working with Mogens and Kim left me with the important lesson that simple toy models, typically only with a few free parameters, can be rather fruitful (and fun) to work with in order to understand little-studied physical phenomena. Kim often claimed that if the toy model had more than one free parameter, it was too many. With a background in high energy physics, where the standard model has more than two dozen free parameters, this took some time to get used to.

As an example of the flexible (and convenient) administrative routines practiced at Nordita, I would like to mention the travel reimbursement routines for visitors. Typically they amounted to handing in your tickets and the boarding passes for the flight completed, to Helle K., the head of the administration and the “mother of Nordita”. Then later in the day, you went to her office, no appointment needed since her door was always open, signed a document she had prepared for you that stated your expenses and per diem, whereupon she went to the safe, counted the right amount of money and handed it over to you. In other words, you did not have to fill complicated forms, provide any kind of bank routing information, sending the boarding pass for your return flights, and wait weeks or maybe months before you received your money. Still to this day, I cannot say that I have experienced a smoother reimbursement process anywhere!

During 2001-2002, I served as the ‘stipendiat representative’ to the Nordita board during an important period for the institute. The Nordic Council of Ministers had just initiated a process that should lead to a change in the financing model for all the Nordic Institutes, Nordita being one of them. The Council wished that all Nordic Institutes should no longer be administrated under and fully funded by them but instead should have host institutions. Today we know that this was the beginning of the process that eventually led to Nordita moving to Stockholm to be hosted by the University of Stockholm and KTH. As a young postdoc being part of the Nordita board during this period (with no voting right) was an interesting experience. It introduced me to the political processes that often appear when important decisions are to be made. Looking back upon the time at Nordita brings back many good memories, and it contributed to shape me as a physicist. ‘To have fun’ is among the important lessons I learned while at Nordita, of course, in addition to the scientific knowledge that I acquired. Now as a faculty member at a physics department, I know that we cannot write this in a research proposal; however, it is still true. If you do not have fun doing your research, you should probably choose another problem to work on.

Bo-Sture Skagerstam, Sweden, 1983-1984

Memories of a Senior Fellow in Diverse Areas of Physics

I was a two-year senior fellow at Nordita in Copenhagen during 1983-84 after PhD studies in Göteborg and London, research and teaching in Göteborg, a postdoc period in Syracuse (N.Y.), and as a fellow at the TH-division at CERN. Even though the Nordita director at that time suggested that I work on something else, the very stimulating research atmosphere in Copenhagen encouraged me to continue my research in theoretical high-energy physics and astroparticle physics. As a fellow at Nordita I, e.g., arranged one of the first Nordic schools on ‘Elementary Particle and the Early Universe’ 1983 in Göteborg with a lot of young participants. My dear and respected colleague K. Kajantie was the main speaker and since then I have always found great pleasure in following his outstanding research. He has always, as then, taken his time to explain many of the deep details of his research. I was also a member of the organizing committees of the ‘Nordita Conference on Monopoles, GUTs and the Early Universe’ held in Copenhagen in 1983 and the ‘1984 Nordic High Energy Meeting in Spåtind’ in Norway. Many of the contacts established during these meetings have lasted until the present time and was, e.g., in particular very useful for me as the Vice-Chairman, Scientific Secretary, and Chief Editor when we arranged the ‘1990 Nobel Symposium on the Birth and Early Evolution of Our Universe’ (NS79) in Sweden together with B. Gustafsson and J. S. Nilsson, one of my mentors, with support from the Nobel Foundation. Several of the participants in that Nobel Symposium later received the Nobel Prize in Physics. During my time at Nordita, I was invited by Academia Sinica in Beijing for a one-month visit to China in 1983 and I gave many lectures in Beijing and Shanghai on lattice gauge theories as well as on grand unified field theories based on work I was carrying out at Nordita in collaboration with, in particular, my dear colleagues P. Salomonson (Göteborg) and A. Stern (Tuscaloosa). During the visit to China I had many opportunities to describe Nordita as a successful research institute and I still remember the very positive and enthusiastic response to my presentations. A time-consuming job carried out during my time at Nordita together with one of my other mentors and friends, J. R. Klauder, eventually resulted in an introduction and preprint volume on ‘Coherent States’ in 1985. This was translated into Chinese in 1986, and has now been cited more than 1600 times.

During the period at Nordita, I was offered to share a room with my dear friend and collaborator Benny Lautrup. His open-minded attitude and pleas-

ant personality opened up my own eyes even more to many of the subtleties of gauge theories and the work on quantum field theory as regularized on a lattice. In a joint work together with J. R. Klauder, C. B. Lang and P. Salomonson we, e.g., studied, at that time, the lack of universality of lattice actions for quantum mechanics. Recently we made use of this work in a study of Levy flights in quantum mechanics.

Lautrup's interest in the development of personal computers and programming, shared with many people in Copenhagen at that time like J. Ambjørn and P. Cvitanović and others, stimulated me to get one of the first, but, unfortunately very heavy, portable personal computers at that time: an almost twenty kilogram Columbia computer which I even was denied to bring on regular flights - it had to be transported by ship between Sweden and Denmark. It was a very useful machine, even though not very transportable, and played some role in the establishment of BITNET in Sweden, a project that I was involved in together with people from IBM in Stockholm. Lautrup's skilful and impressive general programming ability and, at that time, also the programming of microprocessors in terms of machine language, was very useful for me making some simple but very fast numerical routines. Together with a former student of mine, P. Elmfors, Lautrup and I had later a wonderful time together at CERN 1995, when I was a CERN scientific associate, and the collaboration resulted in several publications on a hot topic already at that time: cavity quantum-electrodynamics and one-atom masers, a research field which still occupies a lot of my time.

My overall memory of my time at Nordita is full of positive pictures of a time in science, which was not entirely easy, but endowed with a spirit that the physical world could, after all, be understood from basic and simple principles. Even though people did not always agree on various issues, my time at Nordita showed me that one could, most of the time, in the end reach an acceptable, constructive, and respected consensus of opinions.

It was a great and pleasant time in my life to be at Nordita as a senior fellow, not only as a scientist. The Nordita secretariat acted in an outstanding and professional manner and helped so many of us visitors on all sort of issues in order to facilitate our doing what we all loved to do: contribute to the development of science! This constructive spirit of Nordita is memorable and it is still with me.

Kim Sneppen, Denmark, 1989-1991 and assistant professor 1995-2001

Nordita around the Year 2000

Nordita was a great institution, small yet big in scope, agile in attempting new research directions, a vitality that was ensured by a large flux of young investigators in temporary jobs. I enjoyed the Nordita atmosphere as postdoc (1990-1992), assistant professor (1995-2001) and externally funded professor (2002-2005). This was an extended period that allowed me to learn about complex systems and biology, and help building connections to people with similar interests around the world.

Central, and increasingly atypical for the contemporary way of doing things was Nordita's direct and dynamic way to organize itself. Helle Kilerich was the always smiling and infinitely efficient spirit of Nordita and all its administration, a way of working that was trans-national with ongoing collaboration with both official directors and a vast network of professors from Nordic universities that at some time in their past had been postdocs at Nordita. In the end, as all know, Nordita as we knew it in Copenhagen was crushed on the shoreline of Copenhagen University's centralistic ambitions. It moved to Stockholm, and we in Copenhagen lost Nordita's unique way of doing things.

My last scientific adventure at Nordita was with its director Petter Minnhagen and his colleagues and students from northern Sweden. It was in the age of network science, that also opened for new adventures into biological sciences. For me it was especially fruitful as it gave ample time to develop the ideas for a Center of Excellence on 'Models of Life' that I headed from 2005 to 2015.

Nordita in Copenhagen was indeed a uniquely inspirational institute that throughout its existence rescued the careers of many young scientists, and thereby allowed physics in the Nordic countries to survive also the very harsh times around the end of the Cold War.

Henrik Svensmark, Denmark, 1990-1992

Nordita – a Memory

I was young when I came to Nordita. It was the late summer of 1991, if I remember right. The previous three years had just passed at the physics department at the University of California, Berkeley, USA, and the family longed to go back to Denmark. So while there, I sent off an application for a postdoc position at Nordita and I was successful.

I did not know much about Nordita when I arrived apart from the fact that it would be my ‘home’ for the next two years. There a staff, a few permanent professors, associate professors and all the new postdocs were to be found. I got a desk up under the roof in the main building, but it was always dangerous for me to sit down. Having three small kids, sleep deprivation was the norm and sitting down in front of the desk was, as I said dangerous.

One very vivid part of the daily routine was the coffee breaks at 3 o’clock. It could be a lot of fun. I remember Andreas Wirzba – when his laughter first started there was no stopping, and it was extremely contagious, or Alan Luther would sit with a straight face and say that bacteria had been discovered that could eat radioactivity. He was very good at catching me on the wrong foot before I realized that it was a joke; or Henrik Bruus playing “Maxwell’s Silver Hammer” on the guitar. In fact the social part and interactions of Nordita were amazing.

Now nearly 25 years later I see that period of my professional life as one of the best experiences I have had. And of course we did a lot of physics as well.

Olav Fredrik Syljuåsen, Norway, 1999-2001 and assistant professor, 2001-2006

Memories of a Condensed Matter Physicist

The first time I heard about Nordita was when I was a graduate student at UCLA. We had to read landmark papers in condensed matter physics. Among those were three papers written by people employed at Nordita (Alan Luther on bosonization, John Hertz on quantum critical phenomena, and Chris Pethick on transverse gauge interactions). I remember distinctively how this changed my perception of the quality of physics being done in the Nordic countries, and that in particular Nordita had to be a very high quality institution.

I came to Nordita from the US with my family in 1999. In 2001 I was lucky to get a Nordic Assistant Professorship, so I stayed on at Blegdamsvej until the summer of 2007, half a year after Nordita had moved to Stockholm, when I left for a professorship in Oslo.

My memories of Nordita are intimately connected to Copenhagen. For some reason my memories of Nordita are almost all summer memories. I remember generally the Danish lifestyle: Bicycling to Nordita and home in the evening. The outside lunches with all the wasps. All the delicious unhealthy Danish food. In particular the ‘smørrebrød’ (before the outsourcing of the canteen), and the spandauers (Danishes(!), Wienerbrød) served before the Nordita seminars. The after-lunch coffee with other fellows in the ‘Danish-design’ rooms besides the NBI-canteen. I remember lots of smiling people. People gathering in the Nordita coffee-room joking about nearly everything in life and the universe. Chris’s always witty remarks, and finding myself laughing my head off at Alan’s jokes. I remember the interesting fellows from the Nordic countries and elsewhere, the environment in the attic cubicles, discussing physics with people without having to give introductory lessons to them before they would understand, and people in and out. It also makes an impression when people are as informal as at Nordita. I once had a visitor, used to more formal environments, whom I showed around the institute. In the library we met Ben Mottelson, who was climbing a ladder to get a book from one of the upper shelves. He briefly said hello to us, and we replied. After leaving the room, my visitor quipped, “Oh, what a friendly librarian”. “Yes, he is friendly”, I said, “he also has a Nobel Prize.”

As an organization I remember Nordita as incredibly lean and flexible. I remember facial expressions on visitors when they got their travel money and per diem in cash in a thick envelope. If you needed something: Light

bulbs, travel money, help with tax returns, stamps or something else, you would just ask Helle. No forms, no fuss, no silly rules, and no empty administrative meetings. There is something very valuable, both scientifically and socially, about such an institution as Nordita where young and enthusiastic fellows meet experienced world-class professors in the quest to find and solve important problems in theoretical physics. I am very happy that I have been part of it.

Thomas Tauris, Denmark, 2000-2002

Nordita Fellow, 2000-2002

I arrived at Nordita on a rainy winter morning in early 2000. I was tired. I had driven a lorry all night with my furniture from Amsterdam where I had been a postdoc for 3 years. At the entrance on Blegdamsvej I ran into Georg Bruun whom I vaguely remembered from my student time at Aarhus University. Within a split second we engaged in discussions of all kinds – mainly political since his research area on trapped Fermi gases is absolutely useless for an astrophysicist working on neutron stars. Anyway, we shared an office at Nordita and became good friends for life, despite our numerous quarrels and discussions on everything.

I remember in particular two episodes from my time at Nordita. First of all, I remember the Nordita seminars Thursday morning. These seminars were given by staff members and fellows. After a short while, I realized that the main success criterion for the speaker was to impress the audience with endless formulae, complicated figures and an abstract phenomenology with a hardcore jargon that nobody would understand. The moral was apparently that the less the others understood, the better. I remember preparing my talk on the recycling of neutron stars to produce millisecond pulsars, making a deliberate effort to make the topic as complex as possible. I think I succeeded. Silly me.

While I was at Nordita, the stock market (and in particular NASDAQ) was booming. I got tempted by the possibility to make some big money in finance and one day I quit my job at Nordita to work in a company on mathematical finance and derivatives. However, after 5 weeks I missed neutron stars too much. On my way back from work, I walked into the office of Paul Hoyer, director of Nordita at that time. My problem was that I hadn't been able to get a sabbatical leave from Nordita so I had had to completely quit my contract when I left. Paul Hoyer listened to me for less than a few minutes before he said: "Why don't we just pretend that you never left Nordita in the first place. You can come back and start tomorrow." I was absolutely stunned. What an amazing leader of a scientific institution. A man of real character. I can't help thinking how a typical bureaucratic leader would have reacted. Thanks, Paul.

Vesteinn Thorsson, Iceland, 1992-1995

Nuclear Physics and Astrophysics

My first impression of Nordita stands clear in my mind the crisp white interior, the elegant building with innumerable nooks and crannies, and the upstairs offices with slanting ceilings where I and the other fellows had our desks. A sense of history and place could be strongly felt.

I arrived in Copenhagen in the fall of 1992 after completing a PhD in theoretical nuclear physics from Stony Brook University (USA). I immediately felt very welcome, both by the administrative and the scientific staff. My main collaborator over the three years I spent at Nordita was Chris Pethick. Chris served as a mentor and colleague, as well as a close personal friend. His generosity was unsurpassed. He welcomed my wife and me into his home, where we spent many lively evenings together. When the early birth of our twins caught us unprepared, Chris and Jette brought over cribs and baby clothes from their home. Through collaborating with Chris, my work transitioned further into the realm of astrophysics, a direction that I had begun to explore at Stony Brook. Chris delighted in working out research problems, and his measured and thoughtful approach is one that I try to carry forward in my own work.

The environment at Nordita provided ample opportunities for exposure to new ideas and rich discussions on the latest ideas in my field. Attending the Nordic Summer School on ‘Supernovae, Neutron Stars and Pulsars’ in September 1993 was a unique experience. The school, organized by Nordita, took place at the Abisko Scientific Research Station, located well north of the Arctic Circle, in Sweden. The sensation was one of simultaneously being at a distant point and in a focal region: though the external environment was one of remote tundra, indoors we had the opportunity to learn from highly knowledgeable experts in our field in a relaxed and comfortable setting.

My time at Nordita was integral to my development as a scientific researcher, and provided me with a solid foundation for the next phase of my work at the University of Washington in Seattle, USA. I know that I carry more than a little bit of Nordita with me in my own research work today.

Anna Tollstén, Sweden, 1986-1988

Nordita Impressions 1986-1988

Thinking back about my time in Nordita. the first thing which comes to my mind is always walking along the lakes on a beautiful day in early autumn. Autumn coloured leaves, no wind, the only waves made by ducks. It was my first postgraduate position and my first long term stay abroad and things were very exciting. The first four months I stayed in a small apartment close to the other end of the lakes from Nordita, and by making a short detour I could walk along the lakes to and from work every day.

There was an unusually large crowd of young people around at the time – Nordita and NBI, students, postdocs, and visitors, Scandinavians, other Europeans, Asians and Americans. All of us enthusiastic and dreaming of a future career in physics, a dream which was fulfilled only for a few. That meant there was always something to do in your spare time. Every week we studied ‘This week in Copenhagen’ for interesting things going on, and if there wasn’t anything, we did the standard sightseeing, or went for a beer, a meal, or a movie. Of course everybody didn’t come along every week, but there was always somebody who wanted to come along whenever you wanted to do something. I remember, for instance, several interesting art exhibitions from different ages and cultures, a trip to a small local museum in the north to see an archaeological exhibition, a car trip looking at medieval church paintings, a guided tour through a visiting French research ship, congratulating the Queen on her birthday together with thousands of other people, walks in the parks, in addition to shopping, films and meals in central Copenhagen.

Exotic big city things also happened in our immediate vicinity. Young people from the BZ-movement occupied a house on Ryesgade. Guards in black masks were sitting on a wall I passed on my walk to and from Nordita, and one day there were full scale fights with the police – Blegdamsvej shut off with barricades, and cobblestones in the air. Very cosy compared to modern day events.

For the remainder of my time in Nordita, I lived in an old apartment on the top floor in one of the beautiful turn of the century houses in Frederiksberg. This apartment I shared with a woman doing nuclear physics. This meant virtually a doubling of my crowd of acquaintances, from consisting only of the people doing theoretical high energy physics, cosmology and related stuff, to include also the young nuclear physicists, theoretical and experimental, working as well in Copenhagen as in Risø.

My new flat was a little bit too far for the nice walks to work, so I got myself a bicycle which I used except during one of the winters (the second?) which was exceptionally cold and snowy so I had to rely on the bus.

Thinking back I am amazed that so many of my best memories from a big city are related to nature. The Frederiksberg apartment was very close to Frederiksberg Have where I spent a lot of time walking. I remember enjoying the fantastic show of spring flowers, a colony of herons, the small show gardens in Haveselskabets Have next door, the palace and the Zoo and many walks under the big trees. I also remember lawns yellow with winter aconite in parks all over the city, trips to Dyrehaven, ripe elderberries hanging over the bicycle parking of our back yard, bike rides along the sea coast, and the sun shining on the leaves of the big copper beech outside our living room window.

As already mentioned, one of the winters I spent at Nordita was exceptionally cold. The temperatures stayed below -10°C and we had about 20 cm of snow for several weeks - at least as I remember it. My flat had enormous radiators so we had no problems with heating, but some people lived in newer, more cheaply constructed buildings, and there were stories of pipes bursting, and the main fuses going when people used too many electric heaters. What I remember best is waiting for the bus in the cold standing in a deep layer of mixed salt and snow. You normally had to wait for ten-fifteen minutes and then two or three buses arrived at the same time. If the first, overfull one stopped, you could be in trouble. Sometimes the second empty one just passed, to pick up all the people waiting at the next stop, and you might not even get on. If you were lucky the second one also stopped and you could sit comfortably in an almost empty bus.

I remember how we, who had grown up in places with more winter, were looking down on the poor Danes who didn't know you can't remove snow with salt at so low temperatures. The only result is a very slippery, yielding mixture, which immediately melts and destroys your nice winter boots when you get on the bus or come indoors. I also remember an excursion to Dragør, where I got to see how expensive pleasure boats had been left in the water and were now badly damaged by the ice. Now, of course, I know that winter preparation and equipment is not any better in Malmö. Storing equipment you only need once every 10 or 25 years is not a very good use of tax money.

The most important thing I learnt (outside physics) during my stay in Copenhagen was that Sweden and Denmark were much more different than I had expected. Dealing with the authorities you got the impression you were in a small oasis of helpfulness, where the officials did their best to help you, as soon as you had convinced them that you were trying to comply with the rules, and that, if you had done something wrong, this was an honest

mistake. The contrast with the countries north and south, where rules were rules and nobody cared if you had made a mistake or were deliberately cheating, or even if the rule served any purpose was noticeable.

Regarding material standard of living honours were more even. Everything – houses, furniture, cars, schools, doctors' waiting rooms – appeared older, shabbier and sometimes even dirtier in Copenhagen. Here I think the Danes partly right. It is much better to spend the taxpayers' money on doctors and teachers than on having modern furniture which is replaced as soon as it starts looking worn, and besides, I very much prefer waiting for the doctor on an old, hard, easy to disinfect wooden chair, than in a soft sofa where you can't help wondering what the previous user suffered from. And I also consider it morally wrong to replace old, functioning stuff just because it is old.

On the other hand, neither of the two flats I lived in was up to my standards of cleanliness. The first one appeared like the dream of a small flat in a big city. The only thing it was missing was the view over the roofs – it was unfortunately on the first floor. It belonged to a student of architecture who had restored and furnished it herself. The bed was a mattress on the floor, the table and bookshelves looked like she had built them herself, and the chairs looked like second hand, nicely restored Danish design. The walls were decorated with watercolours made by the same hand, presumably the owner herself. Lovely, wasn't it? However, the small kitchen was designed with open shelves instead of cupboards, and one of my first actions had to be to remove everything and scrub off the grease deposits from both the kitchen equipment and the shelves themselves. And even worse, I discovered that nobody had realised that the stove could actually be moved. So I pulled it out, eyes and nose running, and scraped off about a centimetre thick layer of greasy fluff. But after this initial suffering everything was fine.

After New Year I had to move to something worse. Not the apartment; four rooms and kitchen on the top floor of a house with apartments for the rich built sometimes between 1900 and 1910 in central Frederiksberg. No view over the city here either since the building was in the middle of a side street of a side street, and you only saw the adjacent roofs. On the street side there were three rooms with double doors in between, meant for living and dining rooms. One of them my flatmate used as her bedroom, the other two were our living and dining room. On the back side there was the bedroom which I used as my room, the bathroom, the kitchen, and a small room meant for the maid. This room was retained by the owner of the flat, and officially lived in by her daughter. In reality this daughter lived somewhere else with her boyfriend and only passed by to pick up her mail once a week. No problem so far, except that I hadn't realized that you shouldn't run down

four flights of stairs every morning so I got problems with my left knee as a consequence.

The real problem was that the flat had been sublet to different people for a very long time while the owner was working abroad. And nobody had kept the furniture in shape or cleaned properly during this time. The style of furniture was from about 1960 in the dining room and bedroom, the living room furnished with sofa and armchairs in a style looking at least a generation older, possible imitation, and with big oil paintings of small artistic value decorating the walls. At a first look it all seemed quite fancy. When you looked closer everything was shabby, dusty and falling apart. Everything was just too heavy or in too bad shape to move, so after screwing back the bookshelf which threatened to fall down, into the wall, and cleaning the vacuum cleaner, we also just vacuumed the living area and lived with it. The kitchen was considerably worse. The contents of the cupboards were OK, but the doors of the cupboards and the tiles on the walls were covered in hard oxidized grease. The first time we tried to use the gas fired oven the deposits inside caught fire. Again there was nothing you could do. The fire in the oven cleaned out enough so it was usable afterwards. Just turn off the gas and wait. On the other hand, the wall tiles fell off if you scrubbed them too hard, and the varnish started coming off the cupboard doors when you tried to clean them properly. And in addition to the more or less visible dirt some bug ate my winter woollens inside the big cupboard in my bedroom.

I am probably a bit unfair here. When I moved to Copenhagen I had been living in my own flats with my own furniture for eight years. It is perfectly possible that sublet furnished apartments were as dirty and shabby in the big cities of Sweden at the time, and by now they might be even worse. You read a lot about people who don't know how to clean any longer. Furthermore, I know that many of the extremely shabby and run down houses I saw around me were waiting to be, or in the process of being, restored and instead made into something perhaps too fancy. The change was already noticeable when I was back in Copenhagen and Frederiksberg with my husband in 1992.

I am not going to talk about physics. Even if I managed to hang on longer than many others I never became the scientist I dreamt about being at that time. And it makes me sad to look back at the naive girl I was.

Most of my time as a Nordita fellow I shared an office with two other people, sometimes there was also a fourth. This was before the personal computers. Our office had one timesharing terminal hooked up to a mainframe, a VAX I think. If more than one person needed the terminal the second one had to go down to a terminal room in the basement. You could only type in text. The first graphic screen I used when I got to CERN in 1990. The timesharing terminals were still a great improvement over the punched

cards which were still lying around. This was also the time when everybody started typing their papers themselves instead of handing a hand-written copy to the secretary. We used an early version of Latex. Preprints were still sent out in paper format.

It was the early days of email. There were many different systems but you could at least communicate with friends and collaborators in places with computers – universities and research institutes. Chatting was easy. Just type in a command and start chatting to the person of your choice, as long as he or she was hooked up to the same mainframe, or at least on the network of the same brand of computers. No security, since nobody outside the small community had access. I remember late one evening. It was towards the end of the evening of a Nordita council meeting followed by a dinner with everybody invited, and people had started to leave. I passed the open door of the terminal room in the basement. An American postdoc who was chatting with his collaborator in California turned around and told us Feynman was dead.

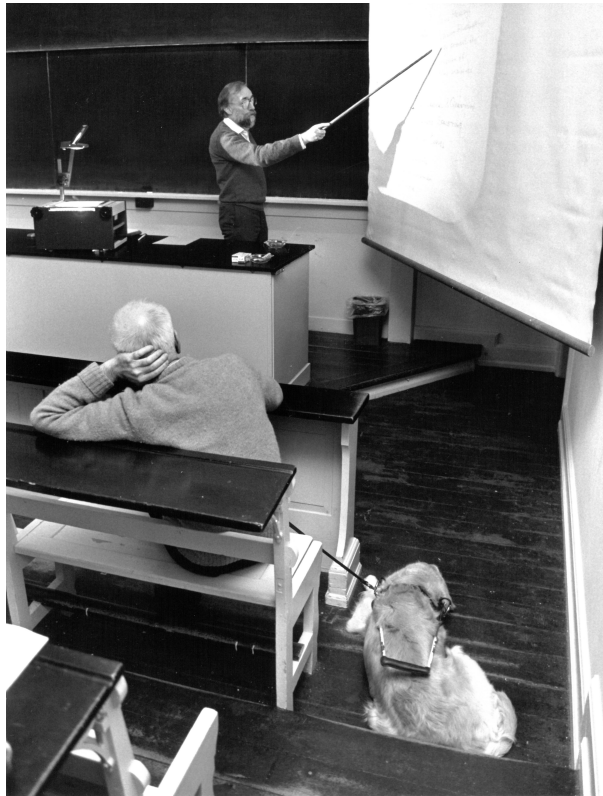
As soon as there were computers the first computer games started appearing. I never played, but remember people chasing or guiding a primitive snake over the screen, and people whining over what happened in ‘Dungeons and Dragons’. Most programmes, including typesetting, ran as batch jobs, so it was nice having something to do while waiting in the terminal room.

A rough estimate counting backwards tells me that the half life of friends you don’t meet is somewhere between five and ten years. I have lost touch with many friends in the physics community over the years. But just like family, you normally don’t bother, some of them you might even prefer not to see, but you know they are there, and if you meet them again you will very soon feel as if they have been around all the time.

Esko Valtaoja, Finnish, 1982-1984

Memories of a Finnish Astrophysics Fellow

I was finishing my licenciate thesis and our new astronomy professor Mauri Valtonen sent me for a two-week visit to Nordita. After a sleepless 24-hour ferry and train journey from Turku I walked from the train station to Blegdamsvej through slowly awakening Copenhagen carrying a ridiculously heavy backpack, found the right entrance, and went to the secretaries' room to announce myself. "Hello, I am Esko Valtaoja", I said and collapsed into a chair in front of Helle Kiilerich's desk. "Yes?" said Helle and looked at me with mild curiosity, as if wondering into what phylum I should be classified. Then she phoned for Richard Epstein, the astrophysics associate professor.



John Campsie and his guide dog Molly listening attentively to a lecture by Kip Thorne (1980s).

Next autumn Richard and Chris Pethick encouraged me to put in an application for a Nordita fellowship. Thinking that they had probably mistaken me for somebody else, I did so. In early September 1982 I was again

standing in Helle's room, still suspecting that the whole thing must be a mistake. I was given some keys and assigned to a desk at the uppermost floor. There was a blind scientist, John Campsie. By common assent his golden retriever guide dog was the most intelligent creature in a building complex filled with Nobel Prize winners; she was the only one who could navigate all the corridors, nooks and crannies of Nordita and Niels Bohr. "Just follow the dog" was the advice given to visitors trying to find their way to the lunch room. The lunch room was certainly worth finding. A Copenhagen master chef had downshifted himself and now prepared utterly delicious smørrebrød and small warm dishes. At times they could stick in your throat when you realized that you were sharing the lunch table with three Nobel Prize winners. There was a white-haired old man whom I first mistook for the retired janitor but who actually turned out to be Hans Bethe, at that time 76 years old but still forging ahead at full speed. "Look, guys", I remember him once admonishing his research group during lunch. "I can't wait for twenty more years for your computers to become powerful enough." Then he picked up a napkin – there was always a huge pile of them ready at every lunch table – and started scribbling supernova equations on it. "It must be the neutrinos, see", he said.

What I remember best was the friendliness, the relaxed, informal atmosphere, the famous Danish *hygge*. It was everywhere, and only increased during the afternoons after everybody had downed some Tuborgs during lunch. The office ladies preferred white wine with their smørrebrød. The stunningly cute secretary from the Faroe Islands started teaching me Faroese and even lent me some novels in that language.

Every morning I would bike from Vanløse to Nordita and climb up the winding stairs to my attic room. Despite the cozy atmosphere I was worried most of the time. Would I ever manage to write even a single scientific paper, not to mention a whole thesis? I remained convinced I was not worthy of the place, and would never be invited to stay another year. Richard consoled me by saying there was no reason to worry and then he suggested I should take a look at the circular polarization of synchrotron radiation. Sometimes I would listen to the North Sea rainstorm drumming into my slanting roof window and glumly look through the lists of previous Nordita fellows. Famous scientists, award winners, professors. Oh, what a shameful footnote I would become! For relief I'd escape to the newspaper room to leaf through the latest *Time* or *New Scientist*, only to wilt under the disapproving stare of the Albert Einstein bust above the door. Even the ancient toilet downstairs was not safe: the founding fathers of quantum physics all have sat here! In total panic I wrote six papers during my two Nordita years and got my thesis.

Susanne Viefers, Norway, 1998-2000

Some Nordita Memories

My ties with Nordita have been close ever since I was a Ph.D. student. Already then I visited Copenhagen a number of times to participate in conferences and summer schools, and grew fond of the institute as well as the city. In particular I remember the summer of 1994. I was a first year Ph.D. student, and just that summer there was both a Nordita summer school (at Spåtind), a conference, and a longer workshop precisely in the field of my PhD studies (anyons/2D physics). I was completely awestruck by the number of world leading scientists in the field attending these meetings, and I felt very privileged to get to know many of them. In the following years I attended several more meetings at Nordita, and thus started building an extensive professional and social network in the Nordic countries and world-wide, which I am still profiting from today. Many of the students and postdocs I met back then, are now my colleagues and friends around the Nordic countries.

Having already experienced the exciting and very friendly atmosphere of Nordita, I didn't hesitate to apply there for my first postdoc position. Thus, in 1998-2000 I spent two wonderful years in Copenhagen. The first two non-trivial problems I had to address was finding a place to stay and someone to work with. Concerning housing, I moved around a bit but eventually ended up in a wonderful, tiny apartment in Nyhavn. My rooms were in fact the old servant's quarters of a huge apartment next door. My landlord and landlady were a rather famous Danish sculptor and a somewhat eccentric teacher of French. They were great. I was invited over for dinners or drinks sometimes, and almost adopted as a family member. On Sunday mornings, Poul (the landlord) would frequently put a bag with fresh croissants and the Sunday newspaper outside my door, and sometimes when returning from some conference trip, I would find a bottle of wine. Incidentally, I also loved Poul's art and ended up buying one of his beautiful sculptures. Finding a collaborator took a bit of time too. I remember talking to a Russian assistant professor who was working in my field. He asked me to tell about my PhD. When I had finished he said "Isn't it time you started doing something interesting" and sent me off with a big pile of papers to read. I decided to keep looking. But with time I got in touch with several people who then turned into long term collaborators and friends, especially Hans Hansson, Stephanie Reimann, Matti Manninen, and not least Ben Mottelson. I still remember the sound of Ben's footsteps, enthusiastically running up the stairs

to my office, two steps at a time, because he was excited about some new idea.

One thing I highly appreciated about the daily life at the institute were the regular morning and afternoon coffee breaks with ‘the girls’ – Helle, Anne, Hanne, Anna Maria and Jette. A varying number of international postdocs and professors would drop in on these, but overall these coffee breaks were a bit of an exposure to Danish culture. For example I learned that when it is somebody’s birthday, you get to drink Gammel Dansk in the morning.

I kept in contact with Nordita after those two years, by attending and organizing conferences, serving on committees, and finally by joining the Board after the move to Stockholm. So Nordita has truly meant a lot to me at all stages of my career, and I have many fond memories.

Jan Vaagen, Norway, 1972-1973 and 1976-1978

Nordita - Home for my Quodlibets (in the spirit of Copenhagen)

The 1985 centenary of Niels Bohr's birth also sparked off publication of a dedicated booklet – in Bergen. The six contributors were all related to Copenhagen and Nordita in one way or the other: Jens Bang (Danish) and Johannes M. Hansteen, among the very first Nordita stipendiates; Ladislav Kocbach (Czech/Norwegian), having arrived in Bergen in turbulent 1968 together with his advisor, Nordita guest professor Peter Vogel; Steingrim Skavlem, Nordita board member; Finn Aaserud, later to become Director of The Niels Bohr Archive; and myself. The contributors all entertained warm feelings, somewhat like the members of Norske Selskab (Norwegian Society) from two centuries back. Former Hanse Office Bergen had historically strong Copenhagen relations. Wilhelm F. K. Christie, the President of the 1814 Parliament (Storting), had been student and state employee in Copenhagen and member of Norske Selskab and was, back in Bergen, inspired to create his own QuodLibet, in 1813. The six authors of the booklet shared a spirit – now fostered by and with focus in physics - and not foreign to the forefathers. In addition to editing, my contribution was a hindsight on “Norwegian Physicists, Niels Bohr and his Institute”, including symbiotically, Nordita. The list of Nordita names contains important players behind Norway's efforts and achievements to become a worthy and visible partner in European physical science.

Springboard to the Physics World

I became a Nordita stipendiate in September 1972. Jens Bang, my lifelong host at NBI, got me started. But within a year I had, somewhat irresponsibly been ‘head-hunted’ to Yale U; by a young associate professor - Robert (Bob) Ascutto - on sabbatical at NBI, with whom I shared a room. My abilities in sport fishing may possibly have played a role for Bob. Essential for our boss at Yale, D. Allan Bromley - later to serve as White House Science Advisor for President George Bush Sr. - was, however, a vision of a venture combining Copenhagen structure theory with American QM coupled channels reaction theory. All aimed at a newly opened field, that of heavy-ion induced multistep nucleon transfer reactions, involving collective nuclear modes, the Copenhagen home field. - We managed to see our predicted interference patterns confirmed in great detail by subsequent pioneering experiments at Brookhaven National Laboratory. The Yale Tandem regrettably did not yet meet the energy requirement. Three years was all the American authorities allowed me to stay. Back at Nordita for 2 years more,

followed by commuting between Bergen and Copenhagen, allowed Jens and me to consolidate our theoretical methods for nuclear overlap functions, with numerous applications. This work also involved other Nordita fellows and visitors, and Bang's Russian collaborators, who now also became mine, in particular Gareev and somewhat later Ershov, both from JINR, Dubna. A 1985 Physics Reports summed up our wisdom.

Cradle of the Russian-Nordic-British Theory (RNBT) Collaboration

The year 1985 saw ground-breaking discoveries at the nuclear driplines, the extremes of nucleon binding. Correct explanations had, however, to wait a few more years. Again Copenhagen got into the middle of the action. The giant reaction cross sections observed by Tanihata's group at Berkeley, for secondary radioactive beams of neutron rich dripline nuclei, were according to the legend the issue of a 1987 lunchroom discussion at NBI where Bang suggested a nuclear halo phenomenon. Experimenters Gregers Hansen (Aarhus) and Björn Jonson (Chalmers, Göteborg) who took part in the discussion, went ahead and tried successfully a poor man's recipe, that of a simple two-body halo model. This paved the way for a better physics understanding, but still not satisfactory for cardinal systems like ${}^6\text{He}$ and ${}^{11}\text{Li}$, which were candidates for a two-neutron halo relative to well defined cores (${}^4\text{He}$ and ${}^9\text{Li}$ respectively), i.e. a three-body model. The problem appealed to our interest in two-nucleon overlap functions. At that time our Russian collaboration was extended to include members from the Kurchatov Institute, in particular Zhukov, Danilin and Shulgina, who became frequent Copenhagen guests. Later also Gridnev, St. Petersburg U, joined the team. In the spirit of glasnost and perestroika, and Bohr's open society, Jens and I wrote a letter to Gorbachev pointing to positive historic Russian experience in Denmark with a more open East-West science communication. Scholars from the UK (Thompson, later Al Khalili, both Surrey U) also joined the work, with shorter and longer Copenhagen visits. Thus a comprehensive theory team was growing, in the cradle of Copenhagen, supported by NBI and Nordita. The larger team's experience with the notoriously difficult three-body problem, and its taste for close collaboration with experimentalists, underpinned the work. What made the task somewhat simpler, was that we noticed that the most outstanding, very weakly bound, super-large, halo nuclei appeared to be composed of three constituents without binary bindings. This simplified the asymptotic behavior, the first continuum threshold being (experimentally confirmed) to be that where all three bodies fall apart. Having successfully explored consequences of this property, we later in our highly cited 1993 Physics Reports, officially coined the name Borromean nuclei, and chose the logo of the Borromean rings; Three rings forming a link, yet no two are linked separately. The rings gave an analog perspective

on quantum structure linked to emergent cluster degrees of freedom. Borromean binding has since been searched for and found in many branches of physics. The rings had already been used as an intellectual aid in the 1960s, in postmodernistic discussion (Lacan). In physics they represent a paradigm that helps understand the exotic architecture of composite quantum matter.

Forwarding Europe's Northern Dimension

Coordinated from Bergen, the RNBT meeting place was still Copenhagen. Here annual Halo Study Weekends, aimed in particular at newcomers and young, were organized with the help of Nordita, NBI and NorFA. Gradually this training tool was exported to RNBT members and to other European institutions, among them ECT* in Trento, the joint European theory centre. Numerous theses around the world carry the ring icon. The RNBT story could not have been told unless experimentalists had become close partners, neither could it without building on complementary insights and gifts in the theory team. Lasting marks in the Nordic landscape were made; Fedorov became professor at Aarhus U. His teacher Zhukov was made professor at Chalmers, and later followed by his student Forssén. In Oslo, Hjorth-Jensen, also with time at Nordita, became a very visible player, still collaborating with my former student Hagen, now employed by Oak Ridge. In Russia, Grigorenko is on the staff of Kurchatov/Dubna. Former RNBT students have positions all over the world.

Nothing lasts forever: some of the pioneers are no longer with us, others have moved to other parts of the world. A core team still carries on - Ershov, Vaagen and Zhukov - focused on the dripline continuum, extending the Borromean paradigm. The new generation favors ab initio nucleon approaches, and are experts in running super-computers. The success on the science catwalk has, however, demonstrated how smaller players, even theorists, may have lasting influence on the development of a big field, if they combine their talents. Nordita and NBI were instrumental to this end and created a setting, a home in Northern Europe, where any question 'quodlibet' on your mind, was allowed.

Matthias Wahde, Sweden, 1997-1999

Brief Recollections of my Time as a Fellow

One of the best parts of being a postdoc at Nordita was the complete freedom to pursue research in any direction desired. This is a great privilege, but also one that comes with great responsibility! During my time as a postdoc, I switched fields from theoretical astrophysics, via bioinformatics, to artificial intelligence, my main field to this day. Nordita is a very stimulating environment. I was fortunate to have the opportunity to work with Professor John Hertz on the topic of bioinformatics. I also remember many discussions with my friend Per Bak, who sadly passed away in 2002.

One of my favorite places at Nordita is the amazing lecture hall where so many of the world's top physicists have lectured or attended seminars. As a postdoc, I would often wander into that hall, gaze at the picture of Bohr, Einstein, Dirac, Heisenberg (and others) in that same room. The room has not changed much since that time! As the room is often empty, I sometimes sat there to read. It is a very inspiring environment indeed.

Nordita (and the Niels Bohr institute) attracts top researchers in various fields, and it is a privilege to meet so many of them. I found everyone, even the most famous Nobel prize winners, to be very friendly and generous with their time. Nordita also arranges guest lectures with very distinguished researchers. For example, I remember a seminar by Sir Roger Penrose, during which a lecture hall intended for around 100 people probably contained at least 200!

One of my most memorable encounters was when Abraham Pais visited the institute. I remember a lunch, attended by Professor Pais and, perhaps, 10-15 postdocs. We were all seated around a circular table in the canteen, and I recall the complete silence (among all of us postdocs) as Professor Pais vividly described his friends Bohr, Einstein, and others.

Andreas Wirzba, Germany, assistant professor 1986-92

My Impressions at, inside and around Nordita

My very first impression of Nordita and the Niels Bohr Institute – arriving as a young PhD student of Gerry Brown at Blegdamsvej 15 – was the intriguing topology and geometry of the buildings and the multitude of ways of getting from one place to another. I did wonder at that time whether I would ever find my way around. During my first stay as a student from summer 1983 to 1984 and also during my time as an assistant professor from fall 1986 to 1992 I always had my office in the K-building of the NBI. Eventually I discovered at least 3 totally different ways to get from there to the Nordita building and back without ever stepping outside any building.

In fact, the topology was so intriguing that even macroscopic tunneling phenomena might have occurred (?). During my first two years as an assistant professor I had the responsibility to organize the general colloquium. One of my first invitees was Sir Michael Berry (at that time not yet knighted). Michael used his spare time to explore the premisses and ‘dungeons’ of the buildings – even further than the rather distant auditorium U. He didn’t report any encounter with dragons but told me instead that he managed to end up in the hygiene institute. Well, I was told from insiders that there is no underground connection to this building. Therefore, there might have been tunneling involved, however unlikely this might sound ...

I told this story in my after-dinner-speech at one of the annual joint Christmas parties of NBI and Nordita, hopefully to the amusement of the people present. Indeed as a young assistant one was not only in charge of the colloquium, but was supposed to give a Christmas speech and to write at least one strophe – fortunately in English – to one of the carols sung at that opportunity. In Danish, it would have been a certified catastrophe. “Jeg har naesten glemt alt det dansk jeg har laert i klassen” was my standard answer when asked about my (progress in) Danish. Nevertheless, I fondly remember the ‘hyggelig’ time at the afternoon coffee breaks in the Nordita kitchen where in a mixture of Danish and English there was small talk with the secretaries, Alan Luther, John Hertz, Paolo Di Vecchia, sometimes Ben Mottelson, and others. I also have to mention the lunch-table meetings with Abraham Pais, Andy Jackson, Alex Lande, and Alan Luther, where great stories and jokes had been told. A limerick about the hump on the back of the camel is still my favorite.

Scientifically, my stay at Nordita was a great time for me. Not only because of my own work – mostly in collaboration with Andy Jackson, some

even with Holger Bech Nielsen, but also for meeting great people from inside and outside the institute, hearing interesting talks at workshops, seminars and colloquia in and beyond my field, and being able to organize workshops by myself – with the help of others of course. I now fondly remember the workshop on ‘Quantum Chaos and Quantum Measurement’ with Predrag Cvitanović and Ian Percival as co-organizers. At the time it was a rather stressful event for me because Helle Kiilerich even had to drive me to see a doctor because of some reddish swellings around my eyes.

As a German, used to strict hierarchy especially about any management issues, I was positively impressed about the openness and the cooperative ways of the weekly Nordita meetings, first headed by the late Allan Mackintosh, then by Chris Pethick. Never before and never after have I felt so much informed and involved in decision processes.

Some final words about the life outside Nordita. That Copenhagen is great doesn’t really need to be stressed here. I enjoyed Copenhagen very much – especially the various jazz events in and around this city, first in the Montmartre club, then in the Copenhagen Jazz House, in the Slukefter at Tivoli and in the annual jazz festivals etc. Once, at Christiania, trying to visit a jazz event, I even had to suffer for this taste: I was bitten by a dog, just because of a wrong turn. But thanks to the Danish health system, there had not been any permanent damage.

A propos Christiania . . . Since I didn’t possess any furniture at that time, I had to rent furnished apartments, mostly on a half-year basis. One rather nice one was on Christianshavns Kanal in the neighborhood of Christiania. While living in that apartment I used to park my cycle in a shed next to the garbage container. One night some idiot put fire to this container. The upshot of this is that I am probably one of the few persons who can report a melt-down of his or her bicycle (especially the newly installed hydraulic brakes were a mess). Fortunately it was not my car since the Danish authorities in their wisdom, being concerned about their taxes and maybe also about my health, ‘convinced’ me to leave my car with my parents in Lübeck.

Appendix A

Some Important Players in the Creation of Nordita

Denmark

Niels Bohr, 1885–1962

After the award of the Dr. Phil. degree at the University of Copenhagen for a thesis on the electron theory of metals, he spent a postdoctoral period in Cambridge and Manchester, where he did his classic work on atomic structure. From 1916, he was professor at the University of Copenhagen and in 1921, the University Institute for Theoretical Physics, for which he took the initiative, was inaugurated. In 1922 he was awarded the Nobel Prize in Physics. Highly respected professionally and a strong supporter of international cooperation, he was very influential in the creation of institutions, both internationally and, in Denmark, the research center at Risø, which was inaugurated in 1958.

Finland

Pekka Jauho, 1923–2015

He received his doctoral degree from the Technical University of Helsinki (now part of Aalto University) in 1951 and was head mathematician at the Kansa insurance company 1951-54. Subsequently he held positions as professor of nuclear physics (1957-66) and professor of physics (1966-1970) at the technical University of Finland 1966-70 and was Director General of VTT, the Finnish state's technical research center (1970-87).

Risto Nieminen in an obituary described how Pekka Jauho was the role model for many generations of Finnish physicists. His scientific breadth, his broad vision, and his ‘sisu’, the Finnish word for tenacity and the ability to persist against all odds, continued to be an inspiration.¹

Pekka Jauho played an important role as the Finnish member of the preliminary group that laid the groundwork for the establishment of a Nordic Institute. As a member of the first Board of Nordita, Pekka Jauho, then 34 years old, was the youngest, and only three others were under 50. He was very active in the work to include solid state physics in Nordita’s research programme.

Iceland

Thorbjörn Sigurgeirsson, 1917–1988

He obtained his mag.scient degree in 1943 from the University of Copenhagen with a thesis on nuclear physics supervised by Christian Møller.² Subsequently he carried out research in nuclear physics in Sweden before studying viruses with, among others, Delbrück, in the USA. Later his interests returned to nuclear physics and he joined John Wheeler’s cosmic ray group before returning to Iceland, where he established an educational programme in modern physics. He spent the period 1.9.52–30.4.1953 at the CERN theoretical study division. His research was mainly in geophysics, and he carried out an extensive aerial magnetic survey of Iceland, flying the aircraft himself. A strong supporter of the creation of Nordita, he was the first Icelandic board member. He became known worldwide in February 1973, for his idea of spraying water on the lava flow that threatened to destroy the town of Heimaey. Despite scepticism on the part of many people, the method was implemented and was successful.³

¹R. Nieminen, Helsingin Sanomat, 19.04.2015

²Most of the material on Sigurgeirsson is taken from Einar Gudmundsson’s blog, <https://uni.hi.is/einar/2021/04/15/thorbjorn-sigurgeirsson-1917-1988-a-brief-overview-of-his-life-and-scientific-work/> .

³‘Lava-Cooling Operations During the 1973 Eruption of Eldfell Volcano, Heimaey, Vestmannaeyjar, Iceland’, Ed. R. S. Williams, U.S. Geological Survey Open-File Report 97-724.

Norway

Johan Peter Holtsmark, 1894–1975

Holtsmark studied physics in Oslo, Würzburg, Leipzig, Göttingen, and London. He became professor at NTH in Trondheim in 1923, and in 1942 he returned to Oslo as professor. In the physics community, he is best known for his introduction (with Faxén) of the partial wave analysis for scattering problems. He actively promoted research in nuclear physics, and in 1935 he, with the assistance of Odd Dahl, initiated construction of a Van de Graaf generator at NTH. There he also built up research in acoustics. He was a strong supporter of the creation of CERN and Nordita.⁴

Egil Andersen Hylleraas, 1898–1965

Hylleraas was the youngest of 11 siblings, and spent a couple of years working in forestry as a teenager. He received his degree in physics in Oslo in 1924, and later obtained fellowships that enabled him to study with Max Born in Göttingen, where he met Niels Bohr, with whom he retained close contact for the rest of his life. Hylleraas's work on the helium atom at that time attracted major interest internationally, and he developed methods for calculating atomic structure more generally. In 1931 he received a professorship in Bergen. Later, in 1937, he accepted a professorship in Oslo. He worked for Norway's participation in CERN and for the establishing of Nordita in Copenhagen.⁵

Svein Rosseland, 1894–1985

After finishing school, Rosseland, the youngest of 9 siblings, worked at a cannery and had a year at a 'folk high school' before beginning studies at Oslo University in 1917. In 1919 he took up a position in Bergen at the Meteorological Institute and in 1920 he came to study in Copenhagen with Niels Bohr. During the period 1924–26 he was a Rockefeller fellow in the USA and he returned to Oslo in 1927, where he obtained his PhD, becoming professor in astrophysics there in 1928. He established and was the head of the Institute for Theoretical Astrophysics in Oslo. After the German occupation of Norway he fled the country and went to the USA, where he was appointed professor at Princeton University. During the last years of World

⁴T. Holtebekk, (13 February 2009), "J. Holtsmark", in Norsk biografisk leksikon. Downloaded 15 January 2016 from https://nbl.snl.no/J_Holtsmark.

⁵T. Holtebekk, (13 February 2009). "Egil A. Hylleraas", in Norsk biografisk leksikon. Downloaded 15 January 2016 from https://nbl.snl.no/Egil_A_Hylleraas.

War II, he worked on military research in London and at Columbia University. After his return to Norway in 1946, he was involved in the development of the Norwegian research institutions, among them the Institute for Energy Technology (1948), and the Harestua Solar Observatory (1954). He was a dedicated spokesman for international cooperation in research.⁶

Harald Wergeland, 1912–1987

Wergeland graduated as a chemical engineer from NTH, Norwegian Technical High School, Trondheim, in 1936. In connection with his study he also had an interest in physics and this interest was encouraged by the professor in physics in Trondheim at that time Johan Holtsmark. In 1937-39 he worked for periods at Werner Heisenberg's institute in Leipzig, and had direct contact to the frontlines of physics at that time. In the period 1939-1945 he was associated to the group of Professor E. Hylleraas in Oslo. In 1946 he accepted a professorship in physics at NTH. Wergeland was a strong supporter of international cooperation in physics, including the establishment of CERN and Nordita. He was one of the founders and chairman of the Norwegian branch of Pugwash, the international organization that works towards a world free of nuclear weapons and other weapons of mass destruction.⁷

Sweden

Torsten Gustafson, 1904–1987

He received his doctoral degree in 1933 in Lund for research in fluid mechanics, especially the Magnus effect. Subsequently, he spent time in Göttingen, where he met Niels Bohr and turned his attention to quantum mechanical problems. From 1939 he was professor of mechanics and mathematical physics in Lund. He was a close friend of Niels Bohr and continued the frequent contact with him and the institute in Copenhagen. Torsten Gustafson was also a close friend of Tage Erlander, who later was a member of the Swedish government from 1939 and Prime Minister from 1946-1969. They met in the beginning of the 1920s in Lund, where they both studied and for a couple of years shared living quarters. Both joined DYG, (De Yngre Gubber, the younger old men) a group of radical socialists. Torsten Gustafson

⁶Ø. Hauge, (13 February, 2009), 'Svein Rosseland', i Norsk biografisk leksikon. (Downloaded 29 August 2018 from https://nbl.snl.no/Svein_Rosseland .

⁷P. C. Hemmer (2009, 13 -februar), 'Harald Wergeland', I Norsk biografisk leksikon, https://nbl.snl.no/Harald_Wergeland .

became an informal advisor to Tage Erlander, they both considered the evaluation of the society to be strongly connected to technical and mathematical research and Torsten Gustafsson was able to promote Swedish science, first of all within physics. He is regarded as an important person in connection with the early research in nuclear energy and the establishment of the Atomforskningsrådet, the Committee of Nuclear Research, in 1945. He was also very influential in Sweden's becoming a member of CERN, and was one of the Swedish delegates for the first 10 years of CERN's existence. His close relationships with Niels Bohr and Tage Erlander were key in the creation of Nordita established in 1957. He was vice-chairman of Nordita's Board for the first five years when Niels Bohr was chairman and, following the death of Niels Bohr in 1962 he became chairman until his retirement in 1969.⁸

Malte Jacobsson, 1985–1966

He received his doctoral degree in philosophy 1910 from Lund University and became professor in philosophy in Gothenburg in 1912. Politically active (social democrat) since his student days. Landshövding (Governor) for Gothenburg and Bohuslän 1934-1950, He was a member of several boards, among these chairman of the atomic committee 1945-58, and he was one of the governmental representatives in the planning of CERN in 1952. In his private life he had connections to the physics arena, since his first wife Emma Stiasny, from Vienna, was a close friend of Lise Meitner, who visited the Jacobssons several times in their summer residence in Sweden. Jacobsson was deeply involved in the creation of Nordita and attended the first Board meetings. He was pleased to be a part of this and especially the frequent informal meetings with Niels Bohr, since they both enjoyed discussing philosophy and other subjects.

Oskar Klein, 1894–1977

Oskar Klein received his early education in Stockholm. He worked for a few years from 1918 with Niels Bohr and H. Kramers in Copenhagen and received his PhD from the University College in Stockholm (University of Stockholm) in 1921. After appointments at the University of Lund and the University of Michigan, he succeeded Heisenberg as 'assistant' at the institute in Copenhagen in 1928 and became professor in mechanics and mathematical physics at the University College in Stockholm. He was a

⁸Sverker Oredsson in 'Physics in Lund - in time and space', pp. 71-73, editors: Bengt Forkman, Kristina Holmin Verdozzi, Department of Physics, Lund (2016). ISBN 978-91-7753-071-8

close friend of the Bohr family. When Niels Bohr had to go to Sweden during WWII he stayed for a few days in the house of Oskar Klein until he went to England and USA; the rest of the Bohr family rented a house opposite the Kleins' and stayed there until they could return to Denmark.⁹ He made many original contributions to physics, among them the Klein–Gordon equation, Kaluza–Klein theories, and the Klein–Nishina formula.

⁹https://en.wikipedia.org/wiki/Oskar_Klein and https://kosmologika.net/Scientists/Klein_english.html

Appendix B

Board Members

Denmark

Niels Bohr, Copenhagen	Chairman 1957-1962
Jørgen K. Bøggild, Copenhagen	1957-31.7.1973
Jens Lindhard, Aarhus	1957-1989
Aage Bohr, NBI	1958-1974, Chairman 1.7.1973-1974
Allan R. Mackintosh, Copenhagen	1978-1983
Aage Winther, Copenhagen	1975-1989, Chairman 1988-1989
Poul Olesen, Copenhagen	1978-1983
Henrik Smith, Copenhagen	1984-1996
Niels Kjær Nielsen, Odense	1984-1989
Poul-Erik Nissen, Aarhus	1990-1992
Aksel Stenholm Jensen, Aarhus	1993-1998
Ole Hansen, Copenhagen	1996-2001, Chairman 2000
Karlheinz Langanke, Aarhus	1999-2003
Poul Henrik Damgaard, Copenhagen	2002-2006
Jens Ulrik Andersen, Aarhus	1.2.2005-2006

Finland

Pekka Jauho, Helsinki	1957-1989, Chairman 1969-1972
Rolf Nevanlinna, Helsinki	1957-1967
Kalervo Vihtori Laurikainen, Helsinki	1959-1970
Karl-Gustav Fogel, Åbo	1960-1983
Pekka Tarjanne, Helsinki	1968-17.8.1977
Alpo Kallio, Oulu	1970-1989, Chairman 1985-1987
Christofer Cronström, Helsinki	17.8.1977-1989
Ebbe Nyman, Helsinki	1984-1989

Keijo Kajantie, Helsinki	1990-1992
Risto Nieminen, Helsinki	1990-1995, Chairman 1993-1995
Paul Hoyer, Helsinki	1.1.1993-30.09.1994
Vesa Ruuskanen, Jyväskylä	1.10.1994-1998
Dan-Olof Riska, Helsinki	1996-2001, Chairman 2001
Matti Manninen, Jyväskylä	1999-2006, Chairman 20.04.2005-31.07.2006
Kari Enqvist, Helsinki	2002-2006

Iceland

Thorbjörn Sigurgeirsson, Reykjavik	1957-1972 and 1981-1983
Magnus Magnusson, Reykjavik	1973-1989, Chairman 1982-1984
Sigfus Johnsen, Reykjavik	1984-1989
Einar Gudmundsson, Reykjavik	1990-1992
Jakob Yngvason, Reykjavik	1990-1995
Thordur Jonsson, Reykjavik	1993-1998
Vidar Gudmundsson, Reykjavik	1996-2001, Chairman 1999
Larus Thorlacius, Reykjavik	2001-2006
Gunnlaugur Björnsson, Reykjavik	2002-2006

Norway

Johan Holtsmark, Oslo	1957-1969
Egil Hylleraas, Oslo	1957-1966
Svein Rosseland, Oslo	1957-1966
Harald Wergeland, Trondheim	1957-1973, Chairman 1972-1973
Steingrim Skavlem, Oslo	1966-1974
Marius Kolsrud, Oslo	1969-1979
Haakon Olsen, Trondheim	1969-1989, Chairman 1978-1981
Per Chr. Hemmer, Trondheim	1974-1992
Johannes M. Hansteen, Bergen	1975-1989
Finn Ravndal, Oslo	1979-1989
Anne-Grete Frodesen, Bergen	1986-1989
Eivind Osnes, Oslo	1994-1996
Kåre Olaussen, Trondheim	1993-1998, Chairman 1996-1997
Jan Vaagen, Bergen	1997-2001
Gaute Einevoll, Bergen	1999-2006, Chairman 2002-2003
Carsten A. Lütken, Oslo	2002-2006

Sweden

Torsten Gustafson, Lund	1957-1970, Chairman 1963-1969
Oskar Klein, Stockholm	1957-1962
Gösta W. Funke, Stockholm	1957-1972 (adviser)
Ivar Waller, Stockholm	1957-1966
Mats Lemne, Stockholm	1972-1985 (adviser)
Nils Svartholm, Stockholm	1962-1971
Lamek Hulthén, Stockholm	1966-1977, Chairman 1975-1977
Sven-Gösta Nilsson, Lund	1970-1979
Jan Nilsson, Gothenburg	1971-1976
Bengt EY Svensson, Lund	1972-1986
Stig Lundqvist, Gothenburg	1976-1980
Carl Nordling, Uppsala	1978-1980
Bengt Nagel, Stockholm	1978-1986
Carl Frederik Berggren, Linköping	1981-1983
Bengt Gustafsson, Uppsala	1981-1990
Arne Claeson, Umeå	1984-1989
Osvaldo Goscinski, Uppsala	1987-1992
Lars Brink, Gothenburg	1987-1995, Chairman 1990-1992
Roland Svensson, Stockholm	1992-1997
Petter Minnhagen, Umeå	1996-2001, Chairman 1998
Claes Fransson, Lund	1997-2001
Cecilia Jarlskog, Lund	2002-2006, Chairman 2004-20.4.2005
Mats Larsson, Stockholm	2002-2006
Anders Flodström, Stockholm	Chairman 1.8.-31.12.2006

Directors of Nordita

Christian Møller, 1957-31.8.1971
 Bengt Strömgren, 1.9.1971-1974
 Aage Bohr, 1975-15.3.1981
 Ben Mottelson, 16.3.1981-1983
 James Hamilton, 1984-1985
 Allan R. Mackintosh, 1986-1988
 Christopher Pethick, 1989-30.9.1994
 Paul Hoyer, 1.10.1994-31.7.2002,
 1.9.2005-31.07.2006
 Petter Minnhagen, 1.8.2002-31.8.2005
 Ulf Wahlgren, 1.8-31.12.2006

Secretary and Legal Adviser

Leo Nielsen, 1957-1988
 Henning Reinholdt Pedersen, 1991-1996
 Hans Henrik Scheibel Nielsen, 1997-2006

Stefan Rozental, NBI/Nordita was also member of the interim board, 1957-1958.

Staff representatives¹

Scientific staff

Alan Luther, 1978-82; C. J. Pethick, 1982-86; J. Hertz, 1986-87; P. Di Vecchia, 1988-91; B. Pagel, 1992-96; J. Hertz, 1997-2006.

Administrative staff²

H. Kiilerich, 1978-1995.

Fellows

J. Randrup, 1978-80; C. Peterson, 1980-81; H. Flyvbjerg, 1981-83; A.-P. Jauho, 1983-84; J. Beyer Nielsen, 1984-85; P. Sibani, 1985-86; P. Hedegaard, 1986-87; R. Madsen, 1987-88; S. Sannan, 1988-89; M. Nordahl, 1989-90; P. Dahlqvist, 1990-91; H. Bruus, 1991-92; J. Kinaret, 1992-94; J. O. Andersen, 1994-96; L. Lönnblad, 1996-97; M. Asplund, 1997-99; P. Pennanen, 1999-2000; Ö. Rognvaldsson, 2000-2001; I. Simonsen, 2001-2002; A. Andersen, 2002-2005; C. Kristjansson, 2005-2006.

¹Positions introduced by NMR in 1978.

²Position abolished in 1995.

Appendix C

Nordita's Scientific Staff

Professors

Christian Møller, Denmark, 1904–1980. Theoretical physics, especially general relativity. mag.scient., Copenhagen University, 1929.

Personal professorship in mathematical physics, 1943. Director of CERN theory group 1954–57. Associated with Nordita as professor and director 1957–71. In field theory, his name is associated with electron–electron scattering (Møller scattering). In quantum chemistry he is known for the Møller–Plesset method for calculating correlation effects, a paper that has more than 13,000 citations on Web of Science. His later work was mainly on general relativity and he was author of one of the first comprehensive textbooks on the subject.

Gunnar Källén, Sweden, 1926–1968. Quantum field theory, particle physics, PhD, Lund, 1950.

Member of the scientific staff at the CERN theory division in Copenhagen, 1952–1957, and at Nordita, 1957–1958. Professor at Lund U., 1958–1968.

Best known for his work on a non-perturbative approach to quantum electrodynamics, he built up a school in Lund working on both formal problems and phenomenology. Died tragically in an air accident.

Ben R. Mottelson, USA/Denmark, 1926–. Nuclear physics, PhD, Harvard, 1950.

Member of the scientific staff at the CERN theory division in Copenhagen, 1952–1957. Professor at Nordita from 1957. In 1975 he, together with Aage Bohr and James Rainwater, received the Nobel Prize in physics for development of the unified model of nuclear structure which embodies the interplay

between collective and single-particle motions. Director of Nordita, 1981–1983.

Léon Rosenfeld, Belgium, 1904–1974. Nuclear physics. PhD, Liège, 1926. During the period 1930–1940 he spent six months a year in Copenhagen working with Niels Bohr. After a professorship in Liège, he became professor in Utrecht in 1940, and moved to Manchester in 1947. Professor at Nordita, 1958–1972. He made contributions to a wide variety of areas of physics and had strong interests in problems in philosophy and the social sciences. Founder of the journal *Nuclear Physics*, 1955.

James Hamilton, Ireland, 1918–2000. Particle physics. PhD, Manchester, 1948.

After positions as lecturer in mathematics at Cambridge (1950–1960) and professor at University College London (1960–1964) he became professor at Nordita in 1964. Director of Nordita 1984–1985. He is best known for his work on the use of dispersion relations in analyzing scattering amplitudes. On his retirement, he returned to Cambridge, where he was associated with the university and wrote the book ‘Aharonov-Bohm and other Cyclic Phenomena’.

Gerald E. Brown, USA, 1926–2013. Nuclear physics, astrophysics. PhD, Yale, 1950, DSc, Birmingham, 1957.

After rising up the ranks at the University of Birmingham, he became professor at Nordita, 1960–1986. Professor at Princeton University, 1964–1968. From 1968–1985 concurrently professor at Nordita and at SUNY Stony Brook. He made important contributions to atomic physics, nuclear physics and astrophysics. One of the founders of the journals *Physics Letters* (1962) and *Physics Reports* (1971).

Christopher Pethick, UK, 1942–. Condensed matter physics, astrophysics. DPhil, Oxford, 1965.

After a postdoctoral position at the University of Illinois, he joined the faculty there in 1970. Professor at Nordita, 1975–2010. Director of Nordita, 1989–1994. He has contributed to understanding of condensed matter systems (quantum liquids and superconductors), cold atomic gases and dense matter in neutron stars.

Alan H. Luther, USA, 1940–. Condensed matter physics. PhD, U. of Maryland, 1967.

After postdoctoral positions at the Technical University of Munich and

Brookhaven National Laboratory, he became in 1971 an assistant professor and later associate professor at Harvard. Professor at Nordita 1976-2008. He is particularly well known for his contributions to the theory of strongly-correlated systems. For his work with V. J. Emery, in which they derived exact solutions for one-dimensional Fermi systems, he received the 2001 Oliver E. Buckley Condensed Matter Prize of the American Physical Society.

John A. Hertz. USA, 1945–. Condensed matter physics and biophysics. PhD, U. of Pennsylvania, 1970.

After a postdoctoral position at the university of Cambridge, he joined the faculty of the University of Chicago, 1973-1980. Professor at Nordita 1981-2013. He initially worked in condensed matter physics and complex systems, especially spin glasses. Beginning in the late 1980s he also worked on neural networks and theoretical neuroscience, which became his main field in the later part of his career.

Paolo Di Vecchia. Italy, 1942–. Particle physics. Laurea, U. of Rome, 1966.

Following positions at Frascati, MIT, and CERN he became assistant professor at Nordita, 1974–78. Following that he was at CERN again, and then professor first at the Freie Universität Berlin, 1979, and then the University of Wuppertal, 1980–86, after which he returned to Nordita as professor. He was one of the early pioneers of string theory, and over the years he has worked on particle physics using perturbative and non-perturbative methods both in field and string theories.

Bernard E. J. Pagel, UK, 1930–2007. Astrophysics. PhD, Cambridge, 1955.

He was an authority on the cosmic abundance of the elements, and became a Fellow of the Royal Society. After appointments at various institutions, most of his career was spent at the Royal Greenwich Observatory, before he became professor at Nordita in 1990. After retiring in 1998 he returned to England and became associated with the University of Sussex.

Dmitri I. Diakanov, USSR, 1947–2012. High energy physics and nuclear physics. PhD, Petersburg Nuclear Physics Institute (PNPI), 1977.

Professor at Nordita 1997–2005, after which he returned to St. Petersburg as Deputy Head of the Theoretical Physics Department, PNPI. He is well-known for his work on the instanton vacuum in QCD, the chiral quark-soliton model of baryons, and mechanisms for colour confinement.

Axel Brandenburg, Germany, 1959–. Astrophysics, PhD, Helsinki, 1990. He has been associated with Nordita for most of his career, as fellow, 1990–1992, assistant professor, 1994–96, and, from 2000, professor. During the period 1996–2000 he was professor of Applied Mathematics the University of Newcastle upon Tyne 1996. He works on astrophysical fluid dynamics, and selected topics in astrobiology. A particular interest in magnetic field generation from turbulent motions, in the Sun and stars, accretion discs, galaxies, and the early Universe.

Directors with fixed-term appointments at Nordita

Bengt Strömgren, Denmark, 1908–1987. Astrophysics. PhD, Copenhagen, 1929.

Professor at Copenhagen University, 1938. Professor at the U. of Chicago, 1951–1957, and at the Institute for Advanced Study, Princeton, 1957–1967. Returned to take up residence in the Carlsberg House of Honour and his professorship at Copenhagen University in 1967. He was associated with Nordita during the years 1967–84, and Nordita's director, 1971–1975. He was one of the towering figures of modern astrophysics.

Allan Mackintosh, UK/Denmark, 1936–1995. Solid state physics. PhD, Cambridge, 1960.

Iowa State U. 1960–66. Professor, DTU, 1966–1970, U. of Copenhagen, 1970–1995. Director of the Danish Atomic Energy Research Establishment (Risø), 1971–1976. Professor and director of Nordita 1986–88. President of the European Physical Society, 1980–1982. He was a leading authority on magnetism of rare earth metals, and became a Fellow of the Royal Society in 1991.

Paul G. Hoyer, Finland, 1945–. High energy physics, PhD, Helsinki, 1973. After postdoc positions at Stony Brook and Lawrence Berkeley Laboratory he became assistant professor at Nordita 1977–1981. Professor at Helsinki University from 1981. Professor and director of Nordita 1994–2002 and 2005–2006.

Petter Minnhagen, Sweden, 1946–. Solid state physics, PhD, Lund, 1976. Nordita fellow 1977–80. After a postdoc position at Indiana U. 1980–82, he was assistant professor Lund U. 1982–84. Associate professor at Umeå U.,

1984–1986, and professor there from 1986. Professor and director of Nordita 2002–2005.

Scientific consultant

Holger Bech Nielsen, Denmark, 1980–1985.
NBI.

Computing staff

John H. Gunn, UK, 1938–. PhD, Birmingham, 1962. After completing his PhD in nuclear physics under the supervision of Gerry Brown, he became Nordita’s computer manager 1962–1972. He then became director of RECKU, and later worked in the computer industry.

Petter Urkedal, Norway, 1971–. PhD, Lund, 2002. Nordita’s computer manager 2002–2006, now special consultant in computing at NBI.

Scientific/Administrative Staff

Stefan Rozental, Poland, 1903–1994. PhD, Krakow, 1928. Worked in nuclear physics, and he was Niels Bohr’s personal assistant for some years. For many years he was in charge of the NBI library. Nordita’s head of administration, 1957–1972.

Nils Robert Nilsson, Sweden, 1926–2012. PhD, Uppsala, 1970. Nordita’s head of administration, 1972–1993, during which period he continued as editor of the journal *Physica Scripta*.

Junior staff

Before the creation of senior fellow and assistant professor positions, shorter term appointments were made in the style of the traditional ‘assistant’ to a member of the professorial staff. Here we list the people by name, together with institutions with which they are presently associated or have had long-term affiliations.

Jens Lyng Petersen, Denmark, high energy physics, 1972–1975.
NBI.

Ikuko Hamamoto-Kuroda, Japan, nuclear physics, 1973–1981.
Lund U.

The creation of assistant professor positions and Nordic senior fellows that were less closely tied to one of the professors made it possible for Nordita to explore new areas rapidly.

Paolo Di Vecchia, Italy, high energy physics, 1974–1978.
Professor at Nordita from 1986.

Finn Ravndal, Norway, high energy physics, 1974–1976.
Oslo U.

Richard Epstein, USA, astrophysics, 1976–1982.
Los Alamos National Laboratory.

Jørgen Randrup, Denmark, nuclear physics, 1976–1979.
Lawrence Berkeley National Laboratory.

Per Bak, Denmark, physics of complex systems, 1977–1978.
Brookhaven National Laboratory, Imperial College (London) and the U. of Copenhagen.

Paul Hoyer, Finland, high energy physics, 1977–1981.
Helsinki U.

Fred Myhrer, Norway, nuclear physics, 1977–1981.
U. of South Carolina.

Carlos Dasso, Argentina, nuclear physics, 1979–1984.
U. of Sevilla.

Predrag Cvitanović, Yugoslavia/Denmark, physics of complex systems, 1980–1984.
NBI, Georgia Institute of Technology.

Jens Nørskov, Denmark, solid state physics, 1982–1987.
DTU, Stanford U.

Bernard J. T. Jones, UK, astrophysics, 1983–1989.
U. of Groningen.

Kari Enqvist, Finland, high energy physics, 1990–1994.
Helsinki U.

Roland Svensson, Sweden, astrophysics, 1985–1990.
Stockholm Observatory, deceased 2003.

Mogens Høgh Jensen, Denmark, physics of complex systems, 1986–1992.
NBI.

Andreas Wirzba, Germany, nuclear physics, 1986–1992.
Forschungszentrum Jülich.

Marek Abramowicz, Poland, astrophysics, 1991–1993.
Chalmers.

Anti-Pekka Jauho, Finland, solid state physics, 1992–1993.
DTU.

Lev Mikheev, Russia, 1992–1995.
Finance sector in USA and UK.

Carsten A. Lütken, Norway, high energy physics, 1992–1993.
Oslo U.

Johan Bijmens, Belgium, high energy physics, 1992–1997.
Lund U.

Jari Kinaret, Finland, condensed matter physics, 1993–1995.
Chalmers.

Alexander Kashlinsky, Israel, astrophysics, 1994–1997.
Goddard Space Flight Center.

Axel Brandenburg, Finland, astrophysics, 1994–1996.
U. of Newcastle, Nordita.

Vladimir Braun, Russia, high energy physics, 1995–1999.
U. of Regensburg.

Kim Sneppen, Denmark, biophysics, 1995–2001.
NBI.

Henning Heiselberg, Denmark, nuclear physics, 1995–2002.
DTU.

Dmitri Khveschenko, Russia, solid state physics, 1996–2000.
U. of North Carolina.

Kari Rummukainen, Finland, high energy physics, 1997–2002.
Helsinki U.

Kimmo Kainulainen, Finland, high energy physics, 1998–2002.
U. of Jyväskylä.

Rachid Oyed, Canada, astrophysics, 1999–2002.
U. of Calgary.

Steen Hannestad, Denmark, astrophysics, 2000–2002.
Aarhus U.

Vadim Cheianov, Russia, solid state physics, 2001–2005.
Lancaster U., U. of Leiden.

Olav Syljuåsen, Norway, solid state physics, 2001–2006.
Oslo U.

Ralf Rapp, Germany, subatomic physics, 2002–2003.
Texas A and M U.

Ralf Metzler, Germany, biophysics, 2002–2006.
TU Munich, U. Potsdam.

Susanne Höfner, Austria, astrophysics, 2003–2004.
Uppsala U.

Charlotte Fløe Kristjansen, Denmark, high energy physics, 2004–2006.
NBI.

Anupam Mazumdar, India, cosmology, 2004–2007.
Lancaster U., U. of Groningen.

Appendix D

Further Reading

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Peter Robertson, ‘The Early Years: The Niels Bohr Institute 1921-1931’, Akademisk Forlag, Copenhagen, 1979.

Stefan Rozental, ‘Stefan Rozentals erindringer’, Hanna Kobylinski, Copenhagen, 1997.

Bengt Strömgren, ‘Christian Møller’, *Overs. Dan. Vid. Selsk.* 1981, p. 98 (1981).



Blegdamsvej 15–17 after removal of the barracks
but before erection of the obelisk (1990s)