



Welcome to the  
**PhD Summer School on Neutrinos 2022**

THE NIELS BOHR INTERNATIONAL ACADEMY

**THERE  
&  
EVERYWHERE**





# Auditorium A at NBI anno 1930





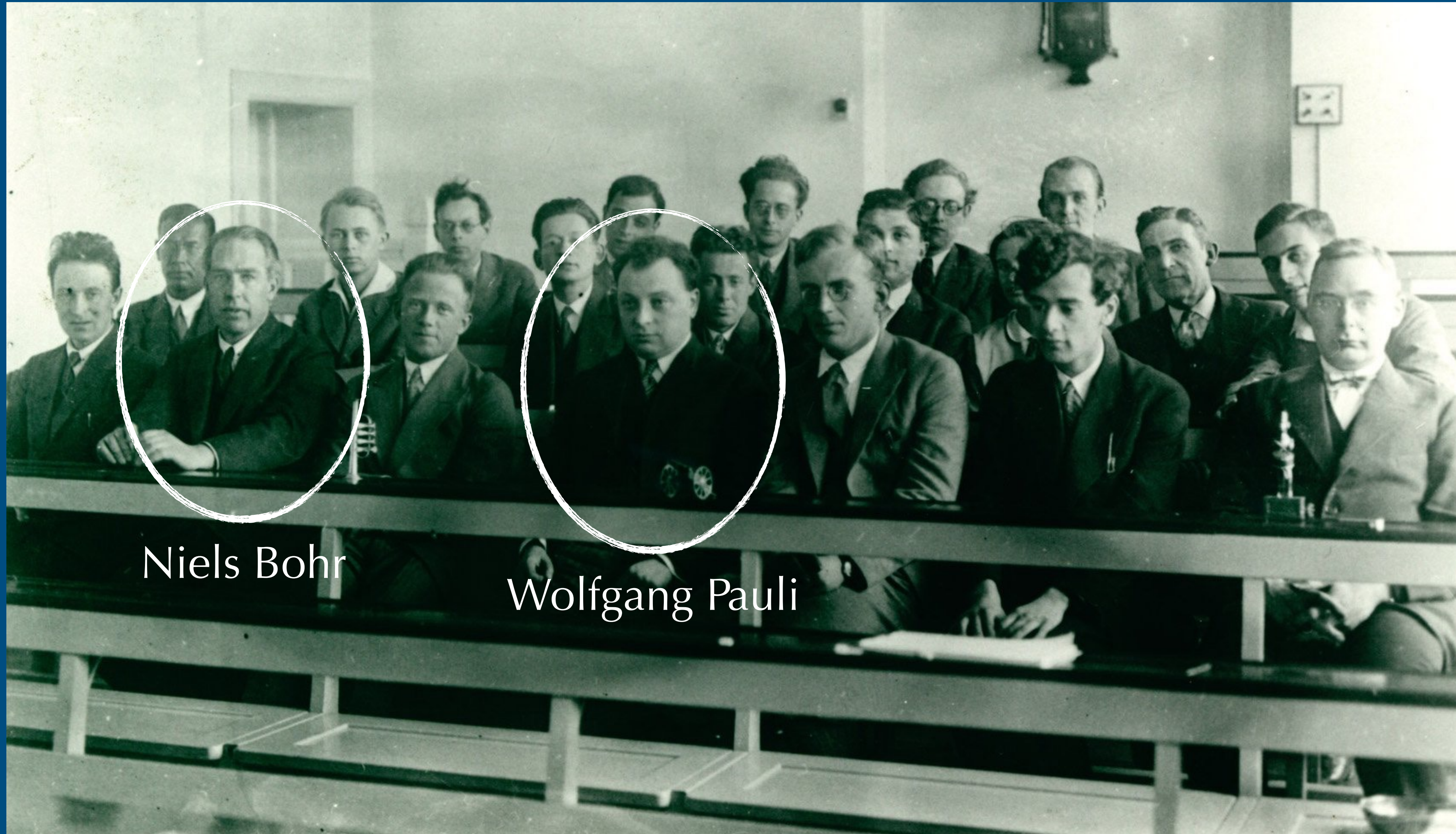
# Auditorium A at NBI anno 1930



Niels Bohr



# Auditorium A at NBI anno 1930



Niels Bohr

Wolfgang Pauli



Offener Brief an die Gruppe der Radioaktiven bei der  
Gauvereins-Tagung zu Tübingen.

Abschrift

Physikalisches Institut  
der Eidg. Technischen Hochschule  
Zürich

Zürich, 4. Dez. 1930  
Oloriastrasse

1 Liebe Radioaktive Damen und Herren,

2 Wie der Ueberbringer dieser Zeilen, den ich mildvollst  
ansuhören bitte, Ihnen des näheren auseinandersetzen wird, bin ich  
angesichts der "falschen" Statistik der N- und Li-6 Kerne, sowie  
des kontinuierlichen beta-Spektrums auf einen verweifelten Ausweg  
verfallen um den "Wechselsatz" (1) der Statistik und den Energiesatz  
zu retten. Nämlich die Möglichkeit, es könnten elektrisch neutrale  
Teilchen, die ich Neutronen nennen will, in den Kernen existieren,  
welche den Spin 1/2 haben und das Ausschliessungsprinzip befolgen und  
sich von Lichtquanten ausserdem noch dadurch unterscheiden, dass sie  
nicht mit Lichtgeschwindigkeit laufen. Die Masse der Neutronen  
müsste von derselben Grössenordnung wie die Elektronenmasse sein und  
jedenfalls nicht grösser als 0,01 Protonenmasse.- Das kontinuierliche  
beta-Spektrum wäre dann verständlich unter der Annahme, dass beim  
beta-Zerfall mit dem Elektron jeweils noch ein Neutron emittiert  
wird, derart, dass die Summe der Energien von Neutron und Elektron  
konstant ist.

4 Nun handelt es sich weiter darum, welche Kräfte auf die  
Neutronen wirken. Das wahrscheinlichste Modell für das Neutron scheint  
mir aus wellenmechanischen Gründen (näheres weiss der Ueberbringer  
dieser Zeilen) dieses zu sein, dass das ruhende Neutron ein  
magnetischer Dipol von einem gewissen Moment  $\mu$  ist. Die Experimente  
verlangen wohl, dass die ionisierende Wirkung eines solchen Neutrons  
nicht grösser sein kann, als die eines gamma-Strahls und darf dann  
wohl nicht grösser sein als  $e \cdot (10^{-13} \text{ cm})$ .

5 Ich traue mich vorläufig aber nicht, etwas über diese Idee  
zu publizieren und wende mich erst vertrauensvoll an Euch, liebe  
Radioaktive, mit der Frage, wie es um den experimentellen Nachweis  
eines solchen Neutrons stände, wenn dieses ein ebensolches oder etwa  
10mal grösseres Durchdringungsvermögen besitzen würde, wie ein  
gamma-Strahl.

6 Ich gebe zu, dass mein Ausweg vielleicht von vornherein  
wenig wahrscheinlich erscheinen wird, weil man die Neutronen, wenn  
sie existieren, wohl schon längst gesehen hätte. Aber nur wer wagt,  
ganz und der Ernst der Situation beim kontinuierlichen beta-Spektrum  
wird durch einen Ausspruch meines verehrten Vorgängers im Amt,  
Herrn Debye, beleuchtet, der mir kürzlich in Brüssel gesagt hat:  
"O, daran soll man am besten gar nicht denken, sowie an die neuen  
Steuern." Darum soll man jeden Weg zur Rettung ernstlich diskutieren.-  
7 Also, liebe Radioaktive, prüfet, und richtet.- Leider kann ich nicht  
persönlich in Tübingen erscheinen, da ich infolge eines in der Nacht  
vom 6. zum 7. Dez. in Zürich stattfindenden Balles hier unatkömmlich  
bin.- Mit vielen Grüssen an Euch, sowie an Herrn Baek, Euer  
untertänigster Diener

ges. W. Pauli

1. Dear Radioactive Ladies and Gentlemen!
2. I have hit upon a desperate remedy to save...the law of conservation of energy.
3. ...there could exist electrically neutral particles, which I will call neutrons, in the nuclei...
4. The continuous beta spectrum would then make sense with the assumption that in beta decay, in addition to the electron, a neutron is emitted such that the sum of the energies of neutron and electron is constant.
5. But so far I do not dare to publish anything about this idea, and trustfully turn first to you, dear radioactive ones, with the question of how likely it is to find experimental evidence for such a neutron...
6. I admit that my remedy may seem almost improbable because one probably would have seen those neutrons, if they exist, for a long time. But nothing ventured, nothing gained...
7. Thus, dear radioactive ones, scrutinize and judge.



# Infos on Indico (nbia.dk/neutrino2022)

The screenshot shows a web browser window with the URL `indico.nbi.ku.dk/event/1731/`. The page features a header with the event title "PhD Summer School on Neutrinos" and the subtitle "Here, There & Everywhere". The dates "July 11-15, 2022" and location "Niels Bohr Institute, Copenhagen" are also displayed. A search bar is present with the placeholder text "Enter your search term". Below the header, a Zoom room link is provided: `https://ucph-ku.zoom.us/j/61850277164?pwd=bW9yN3ltTkFXOXRacjNBSUYvWHZYz09`. A sidebar on the left contains a navigation menu with items: Overview, Timetable, Registration, Speaker List, Participant List, Participant research interests, Connecting to WiFi, Online platform links (Zoom room, YouTube channel, Online etiquette), Local Information, and Getting to the school. The main content area contains three sections: "Online participation (08/06/2022)", "Hotel scam alert (21/04/2022)", and a general invitation from the Niels Bohr International Academy (NBIA). The "Online participation" section states that in-person registration is closed but online participation is possible, with a link to the registration form. The "Hotel scam alert" section warns against a scam service from "Expo Ehotel Services". The invitation section describes the school's aim to bring participants up to date with the latest developments in neutrino physics.

Europe/Copenhagen timezone

Zoom room: <https://ucph-ku.zoom.us/j/61850277164?pwd=bW9yN3ltTkFXOXRacjNBSUYvWHZYz09>

**Online participation (08/06/2022):** In-person registration is closed, but online participation is possible. If you would like to participate of the school online, please complete the [Registration](#) form.

**Hotel scam alert (21/04/2022):** If you received an e-mail from "Expo Ehotel Services" (possibly from docs[at]email.pandadoc.net or sale[at]ehotelservices.org), please ignore it. We have not authorized any such service for the summer school and this seems to be a scam. If you already booked accommodation with them, we strongly suggest that you cancel it right away.

The [Niels Bohr International Academy \(NBIA\)](#) invites PhD students and advanced Master students to the International PhD Summer School on Neutrinos: *Here, There & Everywhere*. This one-week school aims to bring the participants up to date with the latest developments in neutrino physics, from theoretical issues to experimental results, including astrophysical and cosmological aspects.

**The deadline for in-person registration is March 31, 2022. There is no participation fee.**

Students will be given topical introductions, along with an overview of the current state of the field and



# Slack for Discussions

The screenshot shows a Slack workspace interface. At the top, the browser address bar displays 'Search NBIA Neutrino Summer School 2022'. The workspace name 'NBIA Ne...' is visible in the top left. The left sidebar contains a list of channels: '# general' (selected), '# lectures-astro', '# lectures-cosmo', '# lectures-theory', '# random', '# seminars', '# social', '# student-talks', '# travel-accommo...', and '+ Add channels'. Below the channels are 'Direct messages' including 'Slackbot', 'Markus Ahlers y...', and 'Diyaselis Delgad...'. The main content area shows the '# general' channel with a header indicating 97 members. A message from 'Mauricio Bustamante' at 11:37 AM states 'joined #general.'. A date separator for 'Monday, May 9th' is present. Another message from 'Mauricio Bustamante' at 2:35 PM reads: 'Hello, everyone! We will record all lectures, topical seminars, and student talks, and upload them to our YouTube channel. Please subscribe in advance to the channel so that you can receive notifications when a new video is added: <https://www.youtube.com/channel/UCYAN7o4WtgzjxbeJf0SqZnw>.' Below the text is a YouTube channel card for 'NBI Neutrino School' with the tagline 'Share your videos with friends, family, and the world' and a purple circular logo with a white 'ν'. The bottom of the interface shows a message input field with formatting options (bold, italic, link, list, code) and a 'Message #general' label.



# Food & Drinks

- Catered Lunch and Coffee Breaks in Auditorium C
  - Vegetarian and vegan food will be indicated.
- Reception today at 5:30pm (location TBD)
- School dinner on Wednesday (7:00 pm @ FOOD CLUB)
  - directions on Indico



# Student Talks

- Monday - Thursday at 2pm
- 10 min presentation + 2 min for questions
- Find your time slot in Speaker List on Indico.
- We will use our NBI laptop for presentation and streaming.
- Send us your slides before your talk!



# Exercise & Discussion

- Monday, Tuesday & Thursday afternoon
- Exercises from 3:30 - 4:30 pm
  - Work in groups, not just by yourself!
- Discussion from 4:30 - 5:30 pm
  - solutions to problems & general questions on lecture



# COVID Precautions

- We will keep the windows open as much as possible.
- Please use hand sanitizers.
- Masks are not required, but we encourage you to wear them.
  - We have free masks if you need one.
- If you feel sick flux-like symptoms, please try to isolate.
  - We have free quick tests. Access to free PCR tests is easy in DK.



# Local Organizers

If you have questions don't hesitate to get in contact with us:

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# Lecture Topics

*Here*



Neutrino Theory  
& Phenomenology

Joachim Kopp

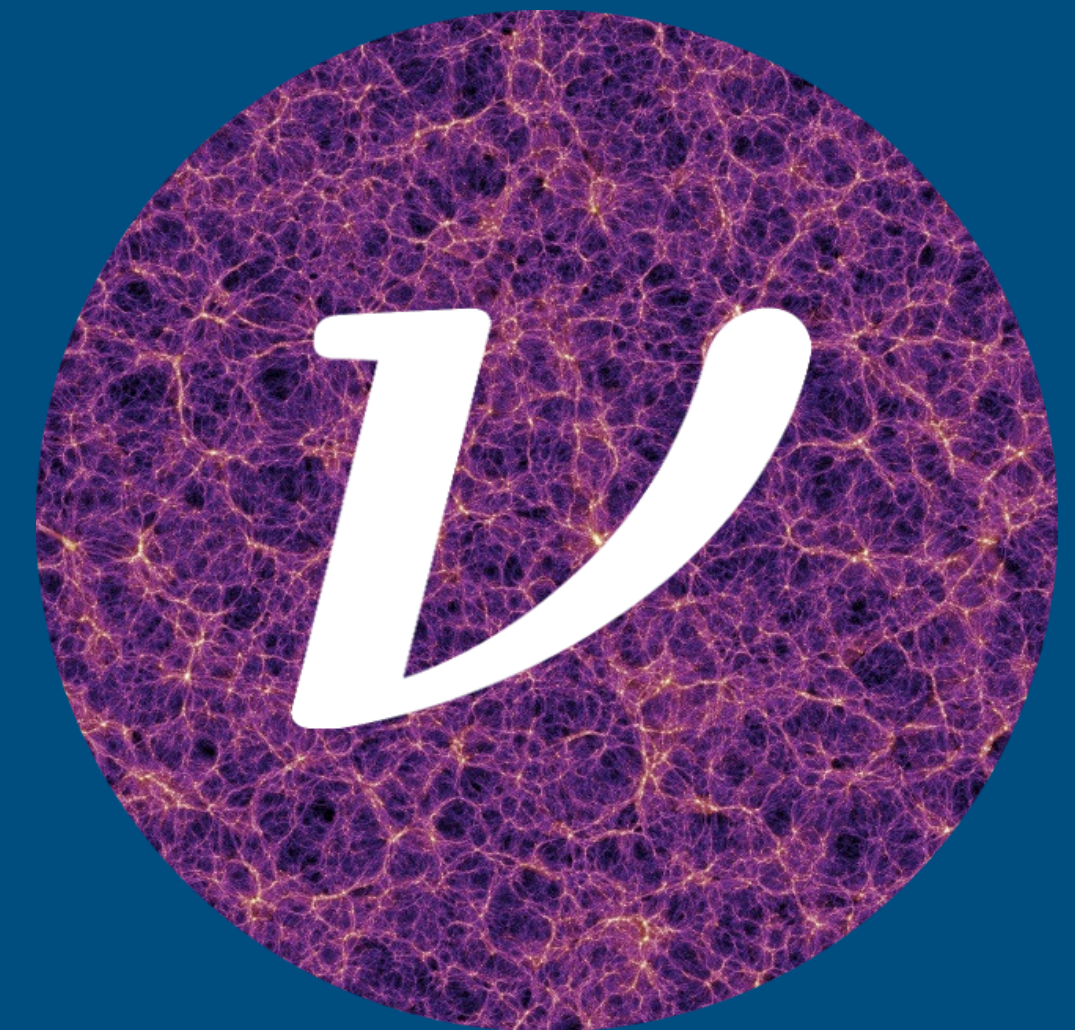
*There*



Neutrino Astrophysics  
& Astronomy

Foteini Oikonomou

*Everywhere*



Neutrino Cosmology

Olga Mena

*+ topical seminars by NBI members*



*Velkommen til  
København!*

