

# Particle Physics in Denmark

Denmark, together with 11 other European countries, was a founding member of CERN in 1954. During the early years of the laboratory, the CERN Theory Group was based in Copenhagen, led by Danish Nobel Laureate Niels Bohr.

From the beginning, Danish physicists have done research at CERN in high-energy physics, nuclear physics and low energy physics. Experimental high-energy physics in Denmark is concentrated in the Niels Bohr Institute (NBI) in Copenhagen. It started with emulsion and bubble chamber experiments, followed by electronic experiments at the ISR and SPS. In the eighties, NBI joined the UA2 experiment at the SPS antiproton-proton collider followed by two experiments – ALEPH and DELPHI – at LEP. In parallel, a heavy ion group was formed, first doing experiments at the SPS (NA44) and the BRAHMS experiment at RHIC at Brookhaven while preparing for the ALICE experiment at the Large Hadron Collider LHC. The two LEP groups have merged and joined the ATLAS experiment at the LHC. This group has also invested a major effort in the development of NorduGrid.

NBI and the Department of Physics and Astronomy (IFA) at the University of Aarhus were amongst the founders of ISOLDE. IFA groups are also involved in fixed target experiments at the SPS and at the low energy antiproton facility.



The ISOLDE Facility

# Medical and life sciences

CERN is the largest driver of development in accelerator technology. Danish medical and life sciences have benefitted from the general development of accelerators, especially in the area of synchrotron-radiation where Danish protein scientists and medical researchers are very prominent. Aarhus University also got valuable assistance from CERN in building their storage ring facility, ISA, which is intensively used by medical research.

In 2014 Denmark will furthermore get its first facilities for hadron therapy, an area where there has been fruitful interplay between physicists from Aarhus University working at CERN and the medical research community.

Biochemists from the University of Copenhagen are using the ISOLDE facility to study the microscopic origins of heavy metal toxicity.

# Energy and the environment

Danish industry related to energy-production and the environment (for example industrial catalyzers and fuel cells) has also made strong use of synchrotron-radiation facilities for research and development of materials. Danish industry is also frequently used by CERN as supplier of energy-saving equipment.

# Communication and new technologies

Many communication technologies have their origin at CERN. For example the World Wide Web and CLOUD computing which has given rise to many innovations around the world, including Denmark. The Danish electronics industry has a fruitful relation with CERN as supplier of many different types of equipment.

# Society and skills

About 30 master students and 20 PhD students do projects at CERN each year, some of those participating in CERN organized and partly CERN financed programs, such as summer students and technical students. These students are in very high demand after completion of their education, not the least because of the training they have received in the well-organized international environment of the CERN experiments. However, the most immediate impact on society simply stems from the great public interest in the science that is being done at CERN. Particle physics is now mandatory curriculum in high school and many groups of teachers and students visit CERN each month.

