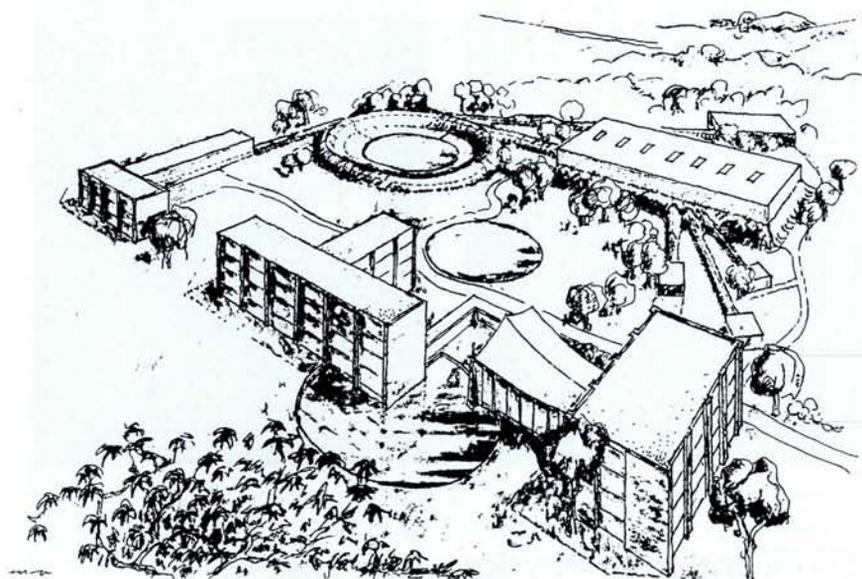


AUSTRON

A Pulsed Neutron Source for the Future

The right project at the right time — this is what AUSTRON promises to be for the scientific world in the near future. AUSTRON aims to create in Austria an international centre based on a pulsed neutron spallation source. The main impact of the AUSTRON project lies in its interdisciplinary application to a wide range of research topics. Apart from studies in physics and medicine, the new source will encompass fundamental and applied aspects of biology, chemistry, materials science, and technology development.



In October 1991, a panel of experts representing more than 50 European research institutes unanimously supported the construction of a neutron spallation source based upon a rapid-cycling proton synchrotron (RCS). The AUSTRON project was born, which in the words of M. Regler, the initiator of AUSTRON, "...will join east and west European countries in a collaborative scientific effort." His commitment, as well as the support of P. Skalicky, the Rector of the Technical University of Vienna, and of 15 other world-renowned Austrian scientists convinced the Austrian Government of the importance of the project.

At the end of December 1992, Dr. E. Busek, Austria's Vice-Chancellor, officially declared that the Austrian Government would support AUSTRON. From then on the political effort has concentrated on finding funds to cover the estimated construction cost of about 220 MECU (3100 MATS), plus eventually another 80 MECU to double the beam intensity. Austria is prepared to pay one-third providing that partner countries contribute the remainder, while a town in lower Austria has offered a site and the necessary infrastructure for the new centre.

The AUSTRON Concept

A workshop held in the Federal Chamber of Commerce in Vienna at the beginning of May 1993 considered in further detail the scientific possibilities of the AUSTRON centre as well as the urgent need for a new, powerful spallation source in Europe. Over

100 scientists from 15 countries participated and the 22 presentations gave invaluable information on AUSTRON's structure and research goals.

To be attractive, a new neutron spallation source must offer a performance equal to or better than that of the present world leader — the ISIS facility at the Rutherford-Appleton Laboratory in the United Kingdom. The overall concept is based on an accelerator with a specially tailored design, and the complex consists of an ion source, a radio-frequency quadrupole, a drift-tube linac, and a rapid-cycling synchrotron. Construction would take five to six years.

The principle advantage of the AUSTRON concept lies in the use of proven accelerator technology in order to minimize costs and the risk of delays. The design nevertheless allows a high beam power to be reached while maintaining a relatively simple target based on an edge-cooled design. By avoiding direct contact of the proton beam with the liquid coolant (water), the compact design facilitates manipulation of

the target and the cooling circuit because hydrolysis of the cooling water, resulting in aggressive chemical attack of the target material, is reduced.

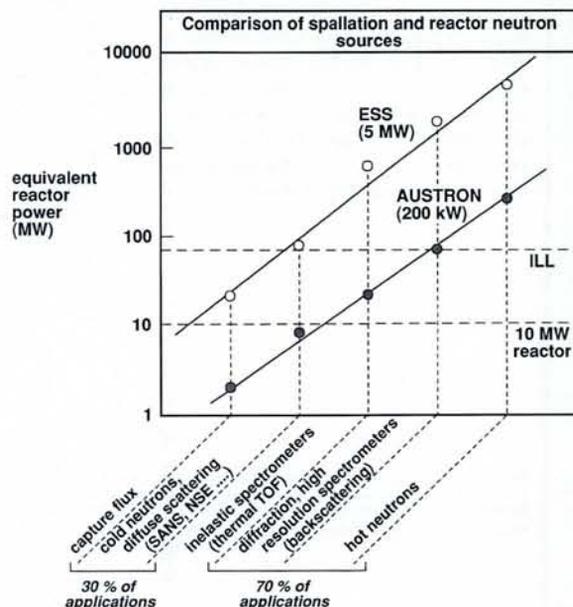
Applications

Even with the basic machine design, AUSTRON will offer protons, neutrons, pions, and muons over a wide energy range up to approximately 1 GeV (a separate target of a simple design is needed for pions and muons). It will also be able to accelerate each second some 10^9 light ions up to energies of 400 MeV/nucleon which can be used in a centre for cancer therapy research attached to AUSTRON.

Light-ion therapy (e.g., with carbon) promises treatment of the 20% of the difficult-to-cure tumours which are radio-resistant when treated with electrons or photons. Light ions travel in virtually straight lines, depositing a large fraction of their energy at the end of their penetration range in the so-called Bragg peak [see *Europhysics News* 23 (1992) 3]. Precise targeting of the dose given to a tumour is possible because the depth distribution of the deposited particles is well defined.

Boron neutron capture therapy is the second of the techniques which appear to offer the most interesting possibilities for treating cancer tumours (indeed, the interest in light-ion and boron capture therapies coincides the European Community's interests). The nuclear reaction of neutrons with boron-10, which has a very large neutron capture cross-section, results in the release of alpha and lithium particles with high kinetic energies. They are stopped by tissue of less than a fraction of a millimetre in thickness, and tumour cells are destroyed in the process. This approach is very valuable for those tumours (e.g., brain tumours) which accumulate boron compounds.

Regarding technology and engineering, the residual stress and temperature of components can be measured, and cracks and fatigue (e.g., in turbine blades or reactor vessels) detected. In biological research, there will be possibility to analyse the structure and dynamics of the basic building



blocks of life such as DNA and RNA molecules, and cell membranes. For the chemical sciences, AUSTRON's main applications will focus on the structure and dynamics of polymers and molecular films where physicists expect to obtain valuable and unique information.

The Present Situation

Negotiations to internationalize and finance the project began in May 1993 and are coordinated by Dr. F. Hamburger, who heads the Vice-Chancellor's cabinet. The Planning Office, headed by M. Schuster, is located at the Atomic Institute of the Austrian Universities in Vienna, while the Accelerator Study Group, led by Ph. Bryant, is based at CERN. Contracts between the main partners (including both international research centres and industry) have already been signed and the feasibility study will be finalised by the end of May 1994, following a short pre-feasibility study that finishes in October 1993. Specialists from the Paul Scherrer Institute (Zurich), the Rutherford-Appelton Laboratory, CERN, the Elettra Synchrotron (Trieste), the Hahn-Meitner-

Institut (Berlin), the Central Research Institute for Physics (Budapest), and the Technical University, Bratislava, are contributing to the latter. A detailed technical design study will follow the feasibility study. With the construction period planned to be only 5 to 6 years from project approval, commissioning of AUSTRON could begin in the year 2000 if technical planning and international negotiations progress rapidly enough (experiments will start to be prepared during the construction phase).

The project has been presented in several European capitals (e.g., Trieste, Budapest, Paris, Bratislava, and Brussels) where it was met with great interest. A fund-raising team will start discussions in Germany and Italy this autumn, and further meetings by the end of the year are scheduled for Switzerland, France and eastern Europe.

AUSTRON is based upon an European partnership inspired by a favourable geo-

AUSTRON: the principle design parameters

Beam power on the target:	150 - 200 kW
Repetition rate:	≤ 25 Hz
Pulse length:	$< 1 \mu\text{s}$
Proton energy:	1.6 GeV
Proton injection energy:	≈ 130 MeV
Ions up to Ne can be accelerated (up to 400 MeV/nucleon)	

graphical situation at a bridge between east and west. It responds to Europe's need for a greater availability of neutrons, especially from pulsed sources, and it represents a major first step towards a future next-generation European Spallation Source [ESS – see *Europhysics News* 24 (1993) 67] while providing the world with its leading pulse neutron facility for use by scientists well into the next century.

Further information is available from:
 AUSTRON Planning Office
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 Tel: +43-1-21 70 12 97; Fax: +43-1-218 92 20.

professor *m/f* of theoretical physics



Katholieke Universiteit Nijmegen

Faculty of Sciences

Faculty

In the Faculty of Sciences of the Catholic University of Nijmegen, teaching and research is carried out in physics, chemistry, biology and environmental studies.

Department: Theoretical Physics I.

The present research themes of the Department of Theoretical Physics I involve the relationship between structure and physical properties (dynamical, optical, spectroscopic, electronic properties and phase transitions). The department is made up of three research groups of which the first is presently active in the group-theoretical characterization of physical systems (not only theoretical but also experimental and computational research is involved). The second group works on statistical physics and the third on the electronic structure of materials.

Responsibilities

The vacancy is in the first group. You will be expected to provide leadership in research, as well as being personally engaged in research in some aspect of the physics of crystals. This research should preferably be complementary to the research interests of the other two groups.

The group is a partner in the Nijmegen research collaboration, the Research Institute for Materials Science (RIM), which consists of both theoretical and experimental groups. Collaboration with RIM, which itself is part of a national network, is required. Another aspect of the position is that both Departments of Theoretical Physics I and II are working towards a national collaboration.

The teaching duties consist of general physics lectures as well as specialist teaching for theoreticians.

Applicants should have

- a broad knowledge and understanding of physics
- considerable experience in scientific research of the highest quality, especially in solid-state physics
- outstanding teaching abilities
- capability for leading and directing a research group
- capability for attracting research funds from the relevant national research councils and from other external sources.

You should also be prepared to undertake managerial and organizational duties within the faculty, as well as national and international professional responsibilities.

A successful candidate from abroad will be required to have a command of Dutch within two years of appointment. The faculty offers equal opportunities for men and women at all levels. Appointment will be full time and permanent in the Faculty of Sciences.

Information and application

More information about this position can be obtained from the chairman of the appointment committee, Prof dr H. van Kempen, tel. int +31 80 65 34 99 or the chairman of the Department of Theoretical Physics I, Prof dr G. Vertogen, tel. int +31 80 65 27 12. Written applications with a curriculum vitae, copies of the five most significant publications, a publication list and the names of three referees, should be sent to Katholieke Universiteit Nijmegen, afdeling Personele Zaken Directoraat B-faculteiten, Toernooiveld 1, 6525 ED Nijmegen, The Netherlands, quoting reference number 25-93. The closing date is October 6, 1993. Anyone who wishes to suggest suitable candidates should contact the chairman of the appointment committee.