PREFACE

The annual report of the *Beschleunigerlaboratorium der Ludwig-Maximilians-Universität München und der Technischen Universität München* for the year 1999 provides information on experimental and theoretical studies performed by physicists from both universities in the field of *Nuclear Physics and Related Topics*. The contributions describe experiments performed at the *Tandem accelerator in München* and investigations pursued at external research centers in which physicists from Munich have played a major role.

The following investigations represent a major field of experiments at the *Tandem accelerator* and cover a broad range of topics from related fields of science:

- The long search for supersymmetry in the level scheme of nuclei has been found by virtue of detailed spectroscopy on various nuclei using the *Q3D spectrometer* at the *tandem*. This work is of great interest and has earned the attention of the full nuclear physics community and beyond. The work was presented in many journals to a wide public.
- Using the AMS technique scientists in this laboratory have contributed substantially to a new calibration of the neutron flux caused by the nuclear bomb in Hiroshima. This will allow to give a much improved estimate on radiation damage and its consequence for humans.
- Crystalline ion beams could be produced for the first time, continuing a long list of works done on single atoms by other scientists.
- The micro probe (*SNAKE*) has been assembled and started first operation
- Numerous work has been continued and partially finished concerning detector and electronic development for large scale experiments performed at outside institutions.
- One of the major activities in an external laboratory (*HADES* at *GSI*) has seen its start up. The set up will be completed in 2000 and first data are expected at the end of that year.
- A new detector laboratory completed. It now hosts a cosmic ray telescope which is used to commission and calibrate the large are muon chambers for the *ATLAS* experiment at the pp collider *LHC* at *CERN*.
- A new experiment searching for 2 proton decay of nuclei close to the drip line has been performed at the NSCL at Michigan State University. The new methods employed overrule previous results obtained in this field.
- The *OPAL* experiment at the electron-positron collider *LEP* at *CERN* has obtained excellent data at energies up to 202 GeV. Analysis efforts have allowed to probe electro-weak theory and to set stringent limits in possible extensions of the standard model.
- Important design and necessary test work has been continued successfully for large scale future activities of the laboratory at the new Munich research reactor, *FRM II* (*MAFF, UCN source*).

The *Tandem accelerator* itself has performed very well, again delivering a wide range of isotopes for all users in a very reliable way, enabling the large amount of work presented in this report to be performed in rather short time.

The theoretical physics associated with the Beschleunigerlabor supports the experiments in the field of nuclear and hadron physics. In particular, help and guidelines for running and future experiments are given on the topics of exotic nuclei, the properties of hadrons in nuclear matter and the study of hadron structure using high energy lepton beams at *DESY* and *CERN*.

The education of young physicists from the two universities in Munich is regarded to be the main obligation of the Beschleunigerlaboratorium. During the year 1999 in total 21 diploma thesis and 7 PhD theses have been completed. The authors of these and the titles of their manuscripts are summarized at the end of this annual report.

With the *FRM II* being built up next door the laboratory has also started to set the way for the future.

With this process still being underway we envisage a restructuring and refocussing of this laboratory to activities around the reactor and at outside laboratories, leaving the present *Tandem accelerator* in a transition phase mostly to be used for applications using nuclear physics methods, developed at this laboratory. This reorganization will most likely start at the end of the year 2000. This will guarantee that the unique features of the existing machines will be also used in the future while most of the nuclear, particle and particle-astro physics will move to different machines. Highlights of such activities are listed below:

- Development of a new accelerator for radioactive ion beams at *CERN (REX-ISOLDE)* and construction of a fission fragment accelerator at the new high-flux reactor *FRM-II* in Garching.
- Development of new methods for the production of ultracold neutrons for the *FRM-II* and setup of a new source for future experiments.
- Detector developments and construction, in particular for the experiments at *CERN: ATLAS* at *LHC, COMPASS*, and *MINIBALL*.
- Studies of the properties of hadrons in hot and dense hadronic matter using the *FRS* and the *HADES* experiment at *GSI*.
- Planning and preparing experiments for the spectroscopy of solar neutrinos in the *Gran Sasso Laboratory* in Italy.
- Search for mechanisms of spontaneous symmetry breaking and signals of new physics at very high energies with the D0 experiment at *Fermilab* continuing the program currently running with the *OPAL* experiment at *CERN*.

In the course of these developments the theoretical physics of both Universities concerned with these fields of research will be linked much closer to the new laboratory, forming a new center for particle and nuclear physics in Munich.

As in all the previous years the budget to run the experiments and the laboratory was provided by the state of Bavaria. Single projects were supported by grants provided by the DFG, the BMBF, the DAAD, the Alexander-Humboldt-Stiftung and the European Union. With this annual report we want to inform all our sponsors and our friends and colleagues about our work, and we want to thank them.

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