PREFACE

This annual report of the *Maier-Leibnitz-Laboratorium für Kern- und Teilchenphysik der Ludwig-Maximilians-Universität München und der Technischen Universität München* (MLL), will summarize last years work of local and external work of the research groups involved in the MLL.

Last year the annual report was being written during the time when the research reactor FRM II in Garching obtained its permission for operation. This year the writing of the report coincides with the first production of neutrons at the FRM II, a major step to routine operation starting this fall. This is also a major milestone towards the realization of the two major MLL projects for the FRM II, the ultra-cold neutron source Mini-D_2 and the fission fragment accelerator MAFF, as well as the start of smaller experiments by MLL scientists at the FRM II.

The contributions in this annual report describe preparations for these projects, investigations pursued at external research facilities in which members of the MLL played a major role, experiments performed at the MLL Tandem accelerator, as well as related theoretical investigations.

In the following some of the highlights from the various activities are summarized:

- A major focus of **nuclear structure research** is the study of nuclei far off the valley of stability in order to study the effective nucleon-nucleon interaction. MLL groups are actively pursuing the construction of the MAFF accelerator for beams of exotic nuclei from fission fragments at the FRM II, which continues on several fronts including source, extraction, and accelerator components as well as future instrumentation.

  The REX-ISOLDE accelerator at CERN is being used in routine operation with first experimental results emerging on neutron-rich Mg and Zn isotopes using the MINIBALL spectrometer.

  At the Tandem accelerator in Garching the Q3D magnetic spectrograph is used for high-resolution spectroscopy of candidate nuclei for supersymmetry, for investigating shape isomers and fission barriers in actinide nuclei and the study of pair transfer. Additionally, experiments on exotic nuclei are also being performed at GSI Darmstadt.

- The Mini-D_2 source for ultra-cold neutrons will perform precision measurements of **fundamental properties of the neutron**, such as its lifetime and the search for an electric dipole moment. The detailed layout for the Mini-D_2 source for ultra-cold neutrons at the FRM II has made significant progress. Various components with relevance to the barrier concept of the source have been successfully tested for their reliability. A test cryostat is completed for first use at the Mainz TRIGA reactor.

- MLL groups are very actively involved in several international collaborations for the **study of the constituents of matter at high energies**. The analysis of the OPAL data from the e^+e^- collider LEP at CERN has lead to more precise values of the mass and decay width of the W-Boson. Data from the DØ experiment at the $p\overline{p}$-collider TeVatron at Fermilab is being used for searches on leptoquarks, the Higgs boson and supersymmetry.

  MLL scientists continue thier contributions to the construction of the next generation experiment ATLAS at the LHC at CERN. The Garching Cosmic-Ray test-facility is continuously improved for the test and calibration of the ATLAS muon-spectrometer drift tube chambers.

- First results are emerging from the COMPASS experiment at CERN which will give clues on the **internal structure of hadrons and their excitations**. Hadron properties in dense and hot nuclear matter are being investigated by the HADES Di-electron spectrometer at GSI, which also has continued its physics program with C+C and p+p experiments. A very active theory program is investigating the various aspects of non-perturbative QCD that are investigated with these experiments.

- MLL scientists are deeply involved in the investigation of the role of non-baryonic particles in the universe, which is the domain of **astro-particle physics**. The major experiments under MLL participation are the GNO and BOREXINO experiments at Gran Sasso which study the integral neutrino spectrum and the monoenergetic ^{7}Be neutrinos, respectively. The development of highly efficient cryogenic detectors for the GNO experiment has progressed and first prototype setups have been successfully tested.

  The CRESST experiment searches for weakly interacting massive particles (WIMPs), predicted by supersymmetric theories. Detector developments and tests for all projects are being performed in the Underground Laboratory in Garching.

- The **Tandem accelerator** and its instrumentation are the backbone for the ongoing high quality nuclear physics and interdisciplinary research performed. In the past year the Tandem accelerator has again performed very reliable. Continuous use of this well performing facility is being foreseen at least until MAFF is operational.

- The **interdisciplinary research using nuclear techniques** has been performed very actively at the Tandem accelerator. High resolution ERD and channeling ERD experiments were performed using the Q3D to determine structural properties and surface properties of semi-conductors and metal alloys.

  The ion beam microscope SNAKE has been successfully used to perform the single-ion irradiation of biological cells, which will study the repair mechanism of the cell after DNA damage through swift ions. This will provide further understanding of the cells survival strategies. The new RadBioMat project has been initiated to develop new materials for use as radioactive implants in brachytherapy.

  The world-wide unique sensitivity of the accelerator mass spectrometry has enabled the measurement of very small isotopic ratios of astrophysical, atmospheric, and geological importance.

- The use of laser beams for cooling, production, and acceleration of ions or electrons is promising new field that is being pursued by MLL scientists in close collaboration with the Max-Planck institute for Quantenoptics in Garching.

Today the laboratory is well positioned to keep making significant contributions to the fields of particle and nuclear physics.

The budget of the MLL provided by the Freistaat Bayern has been the basis for substantial grants by the BMBF, the DFG, the DAAD, the European Union, the Alexander-von-Humboldt Stiftung, and the Bayrische Forschungsstiftung. This annual report serves the information of our sponsors, friends, and colleagues about the work of the past year. We would like to thank them for their support.

Prof. Dr. Reiner Krücken