



II. REPORTS ON RESEARCH

1 DEPARTMENT OF NUCLEAR REACTIONS

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Overview

The Department of Nuclear Reactions had a very productive year. The following reports cover three major domains of our activities: nuclear, material and atomic physics.

One of the current questions in modern nuclear physics is question of the phase transitions in nuclear matter. Our physicists, the members of the ALADIN Collaboration at Gesellschaft für Schwerionenforschung, participated in new experiments exploring properties of highly excited nuclear matter and the phenomenon of the liquid – gas phase transition. The experiments yielded a number of important results. Details can be found in the three short reports presented in this volume.

Structure of a nucleon is another important subject of nuclear science research. In the last year energy region of Δ resonance has been investigated by means of charge exchange reaction. The experiment was performed at Laboratory National Saturne in Saclay by SPESIV- π collaboration consisting of physicist from Institute of Nuclear Physics Orsay, Niels Bohr Institute Copenhagen and from our Department. The main achievement of the experiment was evidence for a Δ - hole attraction in the spin longitudinal channel.

Reactions induced by radioactive ion beams such as ${}^6\text{He}$ recently attract a lot of interest. There exist some evidences that the ${}^6\text{He}$ nucleus has a two-neutron halo structure similar to that well established for ${}^{11}\text{Li}$. An analysis of ${}^6\text{He} + {}^4\text{He}$ scattering data reported in this volume revealed some similarities between the loosely bound ${}^6\text{Li}$ nucleus and the neutron rich ${}^6\text{He}$.

Research in material physics has focused on two basic topics: a crystallographic model of uranium dioxide, a material currently used as a nuclear fuel and transformations of defects in GaAs crystals at low temperature. The investigations have been carried out in a wide collaboration with scientists from the University of Jena, Research Center Karlsruhe and Centre de Spectrometrie Nucleaire Orsay. Some experiments have been performed at the Department using microbeams provided by the Van der Graaff accelerator. The results have been presented at many conferences and workshops.

As far as atomic physics is concerned, the studies of ionisation of M-, N- and O-shell by heavy ions have been continued in collaboration with the Pedagogical University of Kielce and the University of Erlangen. Among others, new results have been obtained for Au, Bi, Th and U nuclei bombarded by oxygen ions. The PIXE method has been used to determine the concentration of trace elements in several biological samples (mainly honey samples) in order to test if those samples as an indicator of soil and air pollution could be used. Moreover, application of solid state nuclear track detectors for detection of heavy ions has been studied using carbon beam of energy ranging from 1 up to 15 MeV. Those detectors are used in various fields of experimental physics.