

Physics

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The activities developed in the Physics Department are mainly oriented to Applied and Fundamental Research on Materials Science. The development of new techniques as well as Education and Training are also relevant subjects. The research groups in the sector have a long tradition of combining High level Education (MSc, PhD, etc) with their own research projects making the department an active scientific centre. The large number of National and International collaborations allows a permanent change of experiences and mobility. This is a condition to keep the research activity in the department at the forefront. The production and maintenance of nuclear instrumentation for industrial uses is also carried on in the sector. The Physics department runs unique facilities in Portugal, for research activities.

1 - Ion Beam Laboratory (IBL) has a 2.5 MV Van de Graaff Accelerator with an ion microprobe end-station and a 210 keV high fluence ion implanter. This infrastructure is open to external users mainly from the University but also from other research Institutions and Industry. A strong engagement on training and education of students and young researchers is maintained leading to collaboration with the Nuclear Physics Centre of the University of Lisbon (CFNUL).

A project to install a high-resolution X-ray detector was approved which will broaden the research activity in the laboratory. The work done at the IBL is used in the fields of material sciences, environment, health, biomedical, atomic and nuclear physics (cross section measurements). The activity developed in the Ion Beam Laboratory is presented in the following pages under the headings *Advanced Materials Research Group, Elemental Characterization and Speciation Group, Group of Biomedical Studies and the Nuclear Reactions Group*.

2 - High Temperature Materials Laboratory^(*) (MA³T) is equipped with a high-resolution, high-temperature diffractometer (*Hotbird*). A project was approved to install a new high intensity beam line, which opens new research possibilities. The current activity is focused on the characterisation of advanced materials used in the electronic industry, high-temperature alloys for fusion applications, superconductors, and ceramic materials. Many of these studies are performed in collaboration with external research groups that request beam time at the *Hotbird* owing to its high specificity and enhanced capability to solve difficult problems, e.g. the characterisation of the strain state, thickness and composition of nanometer-thick buried layers. Temporarily, the work performed in the laboratory

will be merged with the Advanced Materials Research Group.

(*) In May, our colleague António Sequeira passed away in a tragic accident. We all regret this loss, whose impact could be easily evaluated, taking into account that he was responsible for the installation of the x-ray Laboratory and was the leader of the group running the facility. Rest in Peace dear Friend.

3 - Neutron Spectrometers are installed at the ITN nuclear research reactor RPI. Commissioning of the basis configuration of the 2-axis Diffractometer DIDE equipped with a “banana” multidetector took place in 2002. A Small Angle Neutron Scattering Instrument, EPA, is currently under installation. ETV, a TOF Diffractometer for educational purposes is already running. Current research and development work focused on the structural characterization of new materials and instrument optimisation, is carried out in collaboration with national partners and foreign groups notably in Aveiro, Saclay, Budapest and Sofia.

The activities carried out are presented under *Condensed Matter Physics*.

4 - Ionising Radiation facilities – Since 1989 a Co-60 unit (UTR) with a semi-industrial dimension, had been running to develop applied research for Industrial purposes. These activities lead to an incremental interest by Industrials that have in turn led to a joint venture in 2003 for the upgrading and management of UTR by CHIP, with scientific and technical support provided by ITN researchers. In order to develop new radiation technology applications, the upgrading and renewal of the equipment are being carry out by the Radiation Technologies: Processes and Products Group. This project implies ionizing radiation equipment (e.g.: accelerator and gamma experimental facilities), a multidisciplinary laboratory with controlled environment and application of an automation-robotic systems in the facilities.

The main R&D activities for the application of ionising radiation are described under *Radiation Technologies: Processes and Products Group*.

5 - Other activities

The activity of the Nuclear Instruments and Method Group is focussed in Modelling of radiation fields, calculation of neutron physics parameters, measurement of neutron cross-sections; design of electronic instrumentation for nuclear applications; application of electrical discharges in materials and environmental areas; technical assistance in nuclear instrumentation. The activities carried out are presented under the title *Nuclear Instruments and Methods*.

Structure of the Sector and Technical staff

Research groups in the Physics Department

- Ion Beam Laboratory

- Advanced Materials Research Group (GIMA)
- Group of Biomedical Studies
- Elemental Characterization and Speciation (CEEFI)
- Nuclear Reactions Group

- Condensed Matter Physics

- Radiation Technologies: Processes and Products

- Nuclear Instruments and Methods

Administrative and Technical staff

- A. FARIA
- J.V. HENRIQUES
- M. CABAÇA
- M.T. PIRES