

# Physics

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The Physics Department focused its activities on Fundamental and Applied Research as well as Education and Training. The research groups in the sector have a long tradition of combining High level Education (MSc, PhD, etc) with their own research projects contributing to enlighten the place with new ideas. The development and maintenance of nuclear instrumentation for industrial uses are also carried on in the sector. Most of the research undertaken makes use of the large facilities hosted in the Physics Department and unique in Portugal:

**1-The Ion-Beam Laboratory** has a 2.5 MV Van de Graaff Accelerator (able to run at 3.1 MV pushed to its limits) associated with an ion microprobe 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. The engagement on training and education of students and young researchers, originated a strong collaboration between ITN and the Nuclear Physics Centre of the University of Lisbon (CFNUL).

The infrastructure is used in the fields of material sciences, environmental, health, atomic and nuclear physics (cross section measurements). This last subject is carried out by a research group, **Nuclear Reactions Group**, formed with staff from the Universities of Lisbon. The activity developed in the Ion Beam Laboratory is presented in the following pages under the headings **Nuclear Solid State Physics using ion beams**, **Nuclear Reactions and Health and Environmental studies using ion beams**.

**2- The High Temperature Materials Laboratory, Ma<sup>3</sup>t** continues to add new hardware facilities to high-resolution, high-temperature diffractometer, Hotbird, and to implement new software to the current library of experimental procedures and data analysis routines.

The current research activity is focused on the characterisation of advanced materials used in the electronic industry, high-temperature alloys used in the aeronautical industry, superconductors, and ceramic materials. Many of these studies are performed in collaboration with foreign 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 in various electronic devices.

**3-The 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 operational. 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.

Activities pertaining to sections 2. and 3. are presented under Condensed Matter Physics.

**4-The Gamma Radiation facility (UTR)** is Cobalt-60 facility with a semi-industrial dimension constructed in collaboration with the International Atomic Energy Agency (IAEA), as a demonstration unit for the national industry. This unit is now explored by an Industrial consortium with scientific and technical support of the Physics Department. This facility hosts an experimental Cobalt-60 irradiation facility which will be run by the Physics and is dedicated to research activities.

The main Research & Development activities on this field are centred on development of new processes for the application of ionising radiation to Food and Pharmaceutical sterilization and Polymer Industry. A new field is being developed to apply ionising radiation techniques to wastewater treatment. The research carried out is presented under the title **Radiation Technologies Processes and Products**.

## 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

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## Research groups in the Physics Sector

- Nuclear Solid State Using Ion Beams
- Health and Biomedical Studies Using Ion Beams
- Elemental Characterization and Speciation Using Ion Beams
- Nuclear Reactions
- Condensed Matter Physics
- Nuclear Instruments and Methods
- Radiation Technologies: Processes and Products

## Administrative Personnel

- Ana Faria
- Maria Luisa Oliveira

## Technical Personnel

- José Vieira Henriques
- Manuel Cabaça
- Maria Teresa Pires