Physics

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In 2007 the research groups in the Physics Sector ran applied and fundamental science projects in Materials, Environment and Health Sciences. Along with the scientific achievements a major commitment continued on enrolling graduated students in research activities, leading to M.Sc. and Ph.D. theses. The researchers further reinforced the network of collaborations with Institutions and Universities worldwide, continuing the policy of making the installed facilities available to external users. These strategic interactions are fundamental to keep the high output and scientific level of the research work. The following laboratories are hosted in the Physics department:

1 – Ion Beams Laboratory (IBL) has a 2.5 MV Van de Graaff Accelerator with an ion microprobe end-station, a 3 MV tandem accelerator with a micro-AMS system, and a 210 keV high fluence ion implanter. This infrastructure is open to external users and the experimental studies cover the fields of Materials Science, Environment, Health, Biomedical, Atomic and Nuclear Physics (cross-sections measurements). The research highlights will appear in the next pages under the headings *Advanced Materials Research Group, Elemental Characterization and Speciation Group, Group of Biomedical Studies*, and *Nuclear Reactions Group.*

2 – High Temperature Materials Laboratory (MA^3T) with a high-resolution, high-temperature (*Hotbird*) diffractometer and one high resolution diffractometer for low dimensional structures studies. The *Hotbird* with its high specificity and enhanced capabilities is used to solve difficult problems in advanced materials, *e.g.* materials for the electronics industry, high temperature alloys for fusion applications, superconductors, *etc*. The research activity in the laboratory is merged with the Advanced Materials Research Group.

3 – Neutron Spectrometers Laboratory at the ITN nuclear research reactor RPI, comprises one 2-axis diffractometer (DIDE), the SANS instrument (EPA), and a TOF spectrometer for educational purposes (ETV). As the RPI core has been converted from HEU to LEU, it is predicted this change will have an impact in both the total thermal neutron flux and on the signal to noise ratio at these instruments. Work to determine how far they are affected is underway. Research on new polymeric and hybrids materials is in progress, in collaboration with groups in Aveiro, Saclay and Budapest. The activities will be presented under *Condensed Matter Physics.*

4 – Ionising Radiation Laboratory is fitted with a Co-60 unit (UTR) with a semi-industrial dimension that has been running to develop applied research for industrial purposes. In order to develop new radiation technology applications, the upgrading and renewal of the equipment have been carried out by the *Radiation Technologies: Processes and Products Group*. The project implies new ionizing radiation equipment (e.g.: electron accelerator and gamma experimental facilities), a multidisciplinary laboratory with controlled environment, and use of automation-robotic systems in the facilities. The main R&D activities will appear under *Radiation Technologies: Processes and Products Group.*

5 – Nuclear Instruments and Methods Laboratory activities are focussed in modelling radiation fields, calculating neutron physics parameters, measuring neutron cross-sections and application of electric discharges in analytical methods and environmental problems. The design of instrumentation for nuclear applications, and providing of specialized technical assistance in nuclear instrumentation is also part of the activities carried out. These will be presented under the title *Nuclear Instruments and Methods.*

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