

**ICARO-2011**  
**Intensive Course on Accelerator and Reactor Operation**  
**ITN, Sacavém, Lisbon**

**7 a 18 de Março de 2011**

De 7 a 18 de Março de 2011 vai ter lugar no Instituto Tecnológico e Nuclear (ITN) um curso intensivo sobre “Aceleradores e Reactores” organizado pela rede de universidades europeias CHERNE (Cooperation for Higher Education on Radiological and Nuclear Engineering) à qual a Universidade de Coimbra pertence. Trata-se de um curso essencialmente prático que se destina a alunos do mestrado em Engenharia Física, Física ou Engenharia Biomédica. Estudantes de doutoramento podem igualmente participar.

O curso é parcialmente financiado pela Comissão Europeia. Cada aluno é reembolsado de 75% das despesas de viagem (com excepção de táxis). A organização disponibiliza dormida em quartos duplos a título gratuito.

Os interessados deverão enviar carta de manifestação de interesse e CV (incluindo as classificações por disciplina obtidas até ao momento) para [isabel@coimbra.lip.pt](mailto:isabel@coimbra.lip.pt) até ao dia 5 de Novembro de 2010.

Mais informações sobre o curso podem ser encontradas em baixo.

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**7-18 March 2011**

**Total number of students: 24**

**Participating Institutions:**

ITN (PT), University of Coimbra (PT), Politecnico de Milano (IT), Aachen University of Applied Sciences (DE), Haute Ecole Paul-Henri Spaak (BE), XIOS - Technical University Limburg (BE), Polytechnical University of Valencia (ES), Università degli Studi di Catania (IT), Alma Mater Studiorum Università di Bologna (IT), Universitat Politècnica de Catalunya (ES), Czech Technical University in Prague (CZ)

**SUMMARY**

Nuclear techniques are essential in energy production, industry, research, and medicine. The statement of the European Commission of sustainable development clearly shows the importance to preserve and enhance competence in the field of nuclear technology. The main objective of this practical course is to give students the opportunity to practically study the application of nuclear techniques in the environment of an actual working situation, with an access to large equipments (reactor and accelerator) which are not available in most of the partner institutions. The beneficiaries are students in nuclear and radiological engineering or closely related fields of the master level. PhD students may also be admitted. They will be selected at their home institution according

to their willingness to participate, to their academic results, and to their knowledge of the teaching language (English).

The main activities are practical exercises using the facilities of the research centre ITN Lisboa with introductory lectures and round table discussions. Moreover, the participants will learn to include safety aspects and quality culture of applying ionizing radiation in their future work, and will incorporate a consciousness on radiation hygiene. The practical exercises will be organized in international subgroups, allowing the participants to communicate and interact with students of different countries and cultural background.

The course will be organized in Portugal, at the Technological and Nuclear Institute (ITN) of Lisboa. ITN is a State Laboratory under the Ministry of Science, Technology and Further Education, endowed with scientific, administrative and financial autonomy. ITN has as attributions to perform and promote scientific research and technological development, in particular in the field of nuclear sciences and technologies, radiological protection and safety, as well as, in that domain, to undertake graduated and post-graduated education activities and the permanent knowledge update of technicians, and also to promote the public knowledge of science in its areas of specialization. ITN operates unique infrastructures that it makes available to the community, namely the Portuguese Research Reactor, the Van de Graaff accelerator, the ion implanter, the helium liquefier, and the laboratories for dating, isotopes, radiation metrology, and others.

The outcome will be laid down in a booklet of documentation which will be also made available as a CD-ROM and on a permanent web site.

#### DESCRIPTION

**Lectures** (17 academic hours, 12.75 effective hours) on:

- L1: Radiation Protection, Safety and Shielding applied to accelerators & reactors (2.25 h)
- L2: Accelerator principles (1.5 h)
- L3: Ion Beam Techniques (1.5 h)
- L4: Reactor Physics – statics and kinetics (2.25 h)
- L5: Radioisotope production (0.75 h)
- L6: Radiation measurement: specific to accelerators and reactors (2.25 h)
- L7: Future aspects of nuclear technology (2.25 h)

#### Experiments

The experiments will be attended in parallel sessions. All student groups will rotate and participate to all experiments.

A) Three Accelerator-related experiments (4 hours duration each, except A1- 2 hours)

- A1 - Accelerator operation and Calibration
- A2 – Rutherford backscattering spectrometry
- A3 – Particle induce X-ray emission (PIXE) experiment

R) Three Reactor-related experiments (4 hours duration each, except R1- 2 hours):

- R1 - Startup
- R2 - Rod Calibration
- R3 - Isotope Production and Measurement

P) Three modules related to radiation-protection issues & fundamentals:

- P1 -, Radiation Protection , Radiation Safety, Radiation Shielding (half-day)

- P2 – Dosimetry (2 hours duration)
- P3 – Radiation detection and measurement (2 hours duration)

**Round Tables** on Ethics and Sustainability of Nuclear

**Technologies** (4 hours = 2 RT x 2 hours)