RESOURCES OF THE INTER-UNIVERSITY MASTER'S DEGREE IN NUCLEAR PHYSICS

The general resources of the Faculty of Physics at the University of Seville (classrooms with projectors, library, IT room, etc.) are specified in the annex. Similar resources exist in the Faculties of Physics at the other participating universities: the Autonomous University of Madrid, the University of Barcelona, the Complutense University of Madrid, the University of Granada and the University of Salamanca. In addition to these resources, the Master's Degree uses resources specific to Nuclear Physics, especially for the courses with more experimental content: Experimental Nuclear Physics and Applied Nuclear Physics I and II. Students of the Master's Degree have access to resources for these courses in the following centres as indicated below:

CNA: National Accelerator Centre of Seville. The CNA is a combined centre administered by the University of Seville, the Andalusian Autonomous Government and the CSIC. It is a Singular Scientific-Technical Facility (ICTS) devoted to inter-disciplinary research and therefore open to external users. It has three ion accelerators: a 3 MV Tandem Van de Graaff accelerator, a Cyclotron generating 18 MeV proton beams and 9 MeV deuteron beams and a 1 MV Tandem Cockcroft-Walton accelerator, which is used as a mass spectrometer. For more information: http://acdc.sav.us.es/cna

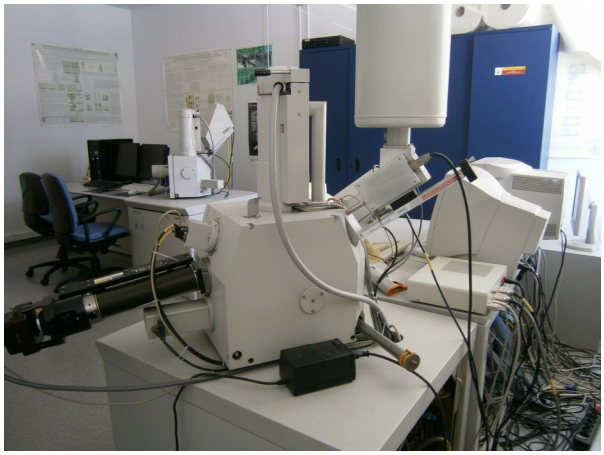
The applications of these three accelerators cover a varied range of fields, including materials science, environmental impact, nuclear and particle physics, nuclear instrumentation, processing of medical images, biomedical research and preclinical molecular imaging and dating.

CMAM: The Materials Microanalysis Centre (CMAM) is a research centre at the Autonomous University of Madrid (UAM) whose main experimental tool is an electrostatic ion accelerator with a maximum terminal voltage of 5 MV, which is used for materials analysis and modification. The CMAM is the result of a project financed with FEDER funding developed under the guidance of the Nicolás Cabrera Materials Science Institute. The main equipment in the centre consists of a tandem electrostatic accelerator with a maximum terminal voltage of 5 MV. It was designed and built by High Voltage Engineering Europe (HVEE) and was the first high-voltage coaxial Tandetron accelerator capable of reaching 5 MV using a Cockroft-Walton voltage multiplier (the maximum voltage previously reached using this method was 3 MV and with the power supply perpendicular to the acceleration column). For more information: https://www.cmam.uam.es

CIEMAT: The CIEMAT (Centre for Energy, Environmental and Technological Research) is a Public Research Body attached to the Ministry of Economy and Competitiveness via the State Secretariat of Research, Development and Innovation. It focuses mainly on the areas of energy and the environment and their related technological fields. The CIEMAT is a midway point between the creation of basic knowledge and the development of industrial applications. Its activities are always oriented towards its role as a bridge between RDI activities and the achievement of social objectives. It has research groups and experiments in progress in various areas of interest to the Master's Degree programme: renewable energies and energy saving, nuclear fission, nuclear fusion. For more information: http://www.ciemat.es

CSIC (IEM, Madrid and IFIC, Valencia): The Materials Structure and Corpuscular Physics Institutes in Madrid and Valencia respectively have important Experimental Nuclear Physics groups with the facilities necessary to carry out experiments and training of young researchers in the field of Nuclear Physics. Their equipment includes different types of detectors (scintillator, semiconductor, INa, etc.), electronic data acquisition and analysis chains, etc.

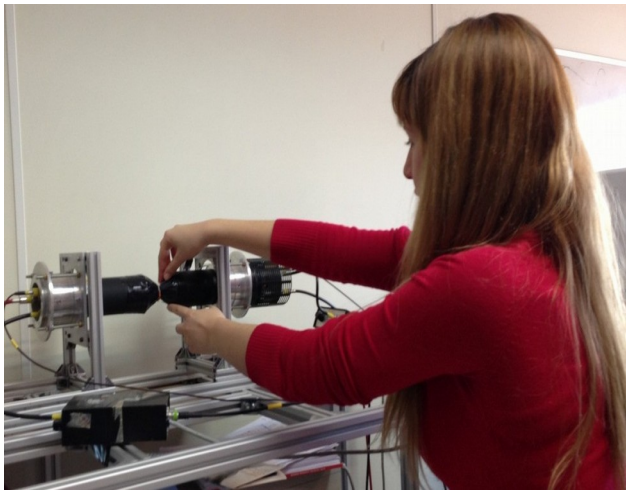
CITIUS: TECHNOLOGICAL RESEARCH AND INNOVATION CENTRE of the University of Seville. This facility offers a range of services, including microscopes, radioisotopes and x-rays. These are of interest to students of our Master's programme carrying out internships in its facilities. For more information: **http://investigacion.us.es/sgi**

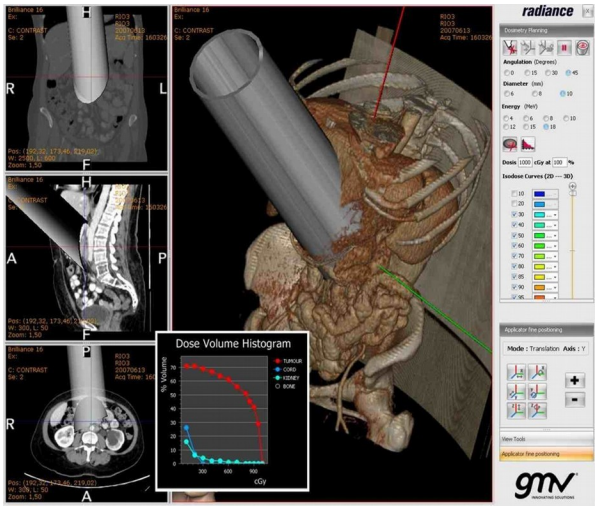


CRAI Antonio de Ulloa: This is the University of Seville's learning and research resource centre. It has fully computerised classrooms used under the Master's Degree programme for computer networking activities as part of the Nuclear Reactions course. There is also a unified library with the following Physics resources:

- Databases: Springer Materials | INSPEC | SciFinder Scholar | ISI Web of Knowledge
- Electronic publications: Nature | Science | Physical Review | Online Archive
- Other electronic and internet resources: Physics links | arXiv.org
- Physimatics: Science and Technology materials with links to the FAMA catalogue

<u>UCM research laboratories:</u> Master's degree students have access to the Nuclear Physics and Medical Applications research laboratories of the Complutense University of Madrid.





ANNEX: General resources of the Faculty of Physics, Seville

The Faculty of Physics at the University of Seville is located on the Reina Mercedes campus together with the other science faculties, in a setting with green areas and open spaces to foster learning and coexistence of the different disciplines. It is located in a six-storey building with access via a large hall equipped with meeting spaces and internet connection. Also located on the ground floor is the Main Lecture Hall with a capacity for 300 students. The building has 10 other classrooms (five with a capacity for 99 students, two with a capacity for 45 students, two with a capacity for 40 students and one with a capacity for 30 students) and three departmental seminar rooms equipped with the latest teaching technology (computers, projectors and display systems, internet connection, etc.). The data network for the entire building was recently fully replaced, with the installation of a high-speed broadband connection and WiFi network throughout the faculty.
In the 2007-2008 academic year, work was carried out to divide various classrooms and equip them with new fittings and audio-visual systems to make more efficient use of the space. Teaching methodologies adapted to working in small groups have also been further developed. In order to meet the present and future demands of the European Higher Education Area, the Faculty of Physics has an IT Classroom on the sixth floor of the building, with 31 workstations equipped with state of the art computers purchased this year. The computers have various operating systems and calculation software packages and applications. The classroom is open in the mornings and afternoons with free student access.

The Faculty Library is located on the first floor and was recently remodelled. It consists of a reading room with materials available on loan, 104 reading desks, a help desk and loan service and the management offices. The collection currently consists of around 6,000 volumes, a video library and an important collection of scientific publications. Students also have computers to access the catalogue and free internet and database access via 20 high-speed internet access points and WiFi. The basement has a Newspaper Library and Study Room with a capacity for 32 students which is independent to the library. There is also a Meeting Room with a capacity for 21 people used for meetings, conferences, thesis readings, etc. and various offices for administration and services. The Student Union, located in the basement, coordinates student participation in the Faculty and the different university bodies.

Also located in the basement is the Faculty of Physics Workshop, which is used for the provision of advice and the design and manufacture of scientific equipment to support teaching and research activities. The building also houses the Departments of Condensed Matter Physics, Electronic and Electromagnetic Physics and Atomic, Molecular and Nuclear Physics, the driving forces behind teaching and research activities in the Faculty.

The Faculty has 12 laboratories for practical work distributed among the three departments mentioned above, offering an extensive range of activities with the most advanced teaching techniques. The research laboratories are used on higher courses to show students the experiments carried out by internationally renowned research groups based in the Faculty of Physics. This outstanding research environment, together with the facilities of the Technological Research and Innovation Centre located on the campus, brings students in direct contact with the latest scientific trends and facilitates a continuation of their professional careers through doctoral theses in leading areas of nuclear physics,

theoretical physics, microelectronics, electromagnetism and materials science. In the 2005-2006 academic year, an interdepartmental practical laboratory was added with a capacity for 50 students. It is fully equipped with exhaust hoods and supplies for the execution of an extensive range of practical experiments. The remodelling of the building's entrance area is currently being completed, including installation of automatic doors and windows with safety glass. The Faculty budget for 2008 was €100,699, an increase compared to the 2007 budget (€87,818). In 2007 and 2008, €24,000 was set aside for purchase of inventory to improve or renovate the infrastructure. The rest of the budget is used to meet the cost of everyday expenses, maintenance and other improvements that do not involve purchase of equipment. It is also worth highlighting that apart from the basic budget, the Faculty of Physics also continuously receives significant funding via projects for specific actions, thereby further guaranteeing the high quality of the activities carried out under the Bachelor's Degree in Physics. Improvements have been carried out in the centre to ensure universal access for the disabled to theoretical and practical classes and the rest of the infrastructure available to students (library, IT room, secretary's office, etc.) either by way of lifts or platforms adapted to the stairs where necessary. The Faculty of Physics is a party to internship and research agreements regulating participation by other entities in the execution of training activities via the Internship Office and the Technology Transfer Office of the University of Seville.