Education in medical physics and nuclear physics at the Faculty of Physics, U. B. Romania - A. Jipa

Education in Medical Physics and Nuclear Physics at the Faculty of Physics, University of Bucharest, Romania

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The first Romanian university was those created by the Prince (Domnitor) Constantin Brâncoveanu, in 1694.The modern University of Bucharest has been created in 1864 through the decree of the Prince (Domnitor) Alexandru Ioan Cuza. At the beginnings ***Physics*** taught at the *Faculty of Sciences*.

From 1948 up to 1962 existed the *Faculty of Physics and Mathematics*. In the last 45 years there is the Faculty of Physics. In 1974 the Faculty of Physics received an special campus on the Physics Platform Magurele, created at the proposal of Professor Horia Hulubei, member of the Romanian Academy, since 1949. The University has 19 faculties and around 30 000 students in this academic year. The Faculty of Physics has 5 study directions organized now in agreement to the Bologna and Berlin statements, namely: *Physics*, *Medical Physics*, *Biophysics*, *Informatics Physics* – with 3 years for license and 2 years for master – *Technological Physics* - with 4 years for license and 1 year for master. There is, too, a *Doctoral School of Physics* with 7 specializations, having 6 semesters.

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Universitatea din Bucureşti (University of Bucharest)
http://www.unibuc.ro

Blvd. Mihail Kogălniceanu, Nr. 36-46, Sector 5, Cod poştal (Postal code) 050107, Bucureşti (Bucharest), ROMANIA, http://www.unibuc.ro

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Universitatea din Bucureşti (University of Bucharest)
Facultatea de Fizică (Faculty of Physics)
http://www.fizica.unibuc.ro

Platforma de Fizică Măgurele (Physics Platform Măgurele)
Bld.Atomiştilor Nr.405, CP MG - 11, RO - 077125

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General information on Romanian universities

** University types classification:*
- after interesting fields: "classical", technical, medical, economical, architecture, arts, mixed
-after financial support: state and private
** Physics studies – mainly at the classical and technical universities*
5 Faculties of Physics at the state Universities from Bucharest, Craiova, Cluj-Napoca, Jassy and Timişoara, 1 Faculty of Physics at private "Hyperion" University Bucharest
** There are different faculties of Sciences at mixed universities with Physics sections combined with Chemistry and Mathematics, mainly*
•Physics at technical universities – General Physics with 1 semester up to 3 semesters with 2 hours course and 2-3 hours practical classes; Nuclear Physics is taught in 1 up to 3 courses, depending on the faculty field; more time accorded to the practical classes
Remarks - At "Politehnica" University there are two faculties with special courses in different Nuclear Physics fields: Power Engineering Faculty – Nuclear Reactors; Applied Sciences Faculty: non-energetic applications of Nuclear Physics
- A section of Technical/Technological Physics at the University of Piteşti (mixed type) – connected with the Institute of Nuclear Research

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Nuclear Physics at the Faculties of Physics

*- A general course in **Nuclear Physics and Particle Physics** – 2 semesters in the second and third study years – 2 hours courses, 2/3 hours practical classes*
*- Special courses for applications of Nuclear Physics and Dosimetry at the **Medical Physics** and **Biophysics** specializations (Bucharest, Cluj-Napoca, Jassy)*
*- Specialization in **Nuclear Physics and Particle Physics** – only at he Faculty of Physics of the University of Bucharest – including master and PhD studies – since '50s*
*-Physics filed - **Nuclear Interactions and Elementary Particles***
*- Applied Sciences field – **Applied Nuclear Physics** (older Nuclear Reactors and Nuclear Materials)*
Personal remark – the specialization in Nuclear and Particle Physics, as well as all specializations in other Physics fields are strongly affected by the Bologna education system
*Remark: At the Faculty of Physics from the University of Bucharest the teaching and research activities in the **Nuclear and Particle Physics** filed are performed, mainly, in two chairs (departments), namely: Atomic and Nuclear Physics Chair (Department), Theoretical Physics and Mathematics Chair (Department), and **Medical Physics** at the Electricity and Biophysics, mainly, but there are activities at all 6 chairs*

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Special courses in Nuclear and Particle Physics

I. Nuclear Interactions and Elementary Particles
(in the 4th study year – 2 semesters)

I.1. Nuclear Structure Models and Reaction Mechanisms
I.2. Experimental Methods in Nuclear and Particle Physics
I.3. Symmetries and conservation rules in Nuclear and Particle Physics
I.4. Introduction in High Energy Physics and Cosmology
Remarks: In the academic year 2007-2008 will graduate the first promotion in the "Bologna style" – only 3 courses in the last semester (Physics section, Physics field, 3 study years).

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II. Applied Nuclear Physics

II.1. Fundamentals of the Modelations for Nuclear Structure and Interaction Mechanisms
II.2. Experimental Methods in Nuclear Physics
II.3. Fission and Fusion Reactions
II.4. Nuclear Reactor Physics and Nuclear Energetics
II.5. Calculation and Simulation Methods in Nuclear Physics
II.6. Technologies and Installations for Nuclear Energetics. Management of the Nuclear Wastes
II.7. Dosimetry, Radioprotection and Nuclear Management
II.8. Applications of the Nuclear Radiations
II.9. Environment Radioactivity
Remarks: In the academic year 2008-2009 will graduate the first promotion in the "Bologna style" – only 6 courses in the last 3 semesters (Technological Physics section – Applied Science filed, 4 study years).

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I. Modern Problems in Atomic Physics, Nuclear Physics and Astrophysics
I.1. Anomal States and Phase Transitions in Nuclear Matter
I.2. Cosmology and High Energy Physics
I.3. Modern Problems of the Nuclear Physics. Theoretical Aspects
I.4. Modern Problems in Particle Physics
I.5. Reactor Physics. New trends and perspectives
II. Experimental Atomic Physics, Nuclear Physics and Astrophysics
II.1. Relativistic Nuclear Physics
II.2. Heavy Ion Reactions
II.3. Hadronic Spectroscopy
II.4. Nuclear Spectroscopy
II.5. Modern Problems of the Nuclear Physics. Experimental Aspects
III. Experimental Methods. Experimental Data Bases and Calculation Codes
III.1. Processing of the information from detectors
III.2. Processing of the Experimental Data and Using of the Programs Libraries
III.3. Nuclear Methods for Structural Analysis
III.4. Informational Systems. Nuclear Models. Nuclear Data Bases and Calculation Codes in Nuclear Science
III.5. Radiations, Nuclear Instrumentation and Applications

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Master studies

*Master studies - old structure – in the period 2000-2007, because financial considerations - only one common specialization direction (initially – 3 directions at the Atomic and Nuclear Physics Chair, namely: 2 in Nuclear Physics (**Nuclear Interactions and Elementary Particles** – for Physics section, **Applied Nuclear Physics** – for Technological Physics) and one in **Physics of the Atoms and Molecules and Astrophysics**. In this common Master specialization direction (called **Atomic and Nuclear Interactions, Elementary Particles, Astrophysics and Applications)** each previous specialization kept its identity, as well as the number of courses, only the titles are common, and the professors teaching these courses have o diminished number of hours in their positions to respect the restrictive financial conditions.*

Remark. The new structure for Master studies will be applied from the next academic year. A more complicated structure with 6 general courses for all specialisations, 6 common courses for a few specialisations and 5 strictly specialised courses, in 4 semesters, is approved by the Professors' Council.

The three generic titles of the courses and their substructures, for Nuclear and Particle Physics, are the following (some courses are common or are taught for 2 semesters):

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Ph.D. studies

*Since the academic year 2005-2006 - Doctoral School of Physics - 7 departments – department of **Atomic and Nuclear Interactions, Elementary Particles, Astrophysics and Applications,** department of **Medical Physics and Biophysics***

Ph.D. studies – 3 (2) semesters of courses and seminars
3 (4) semesters only for research.

- Now: first two semesters - 2 general courses with a structure in agreement with the scientific fields of the department
- 2 specific course taught by the Ph.D advisor and his collaborators.

Obs. 1. After each course the students are tested. After the last examination, the students will present and work with a subject related to the thesis field at the department commission. This last and major examination will permit to the Ph.D. student to work only to the Ph.D. thesis.
2. The direction has the highest number of PhD advisors and students, too.
3. First promotion is in the PhD Theses presentation period

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Post university courses in Nuclear Physics and applications

At the Atomic and Nuclear Physics Chair, Faculty of Physics, University of Bucharest is organized in each academic year a study direction, at post university level, for bachelors in different fields, named ***Using of the Radioactive Isotopes*** *(since '50s). The expertise of the chair members permits courses in 4 directions (Applications of Nuclear Physics in Medicine and Biology, Nondestructive Testing, Nuclear Spectroscopy for different fields, Nuclear Reactors and Energetics). There are 3 periods of two weeks each with 9 courses (243 hours of courses and laboratories). In the first period four courses are taught, namely: Fundamentals of Nuclear Physics, Dosimetry, Processing of the Experimental Data in Nuclear Physics, Detection Methods of the Nuclear Radiation. In the second period are taught 3 courses, depending of the professional interests of the participants. Other two courses (Legislation in Nuclear Sciences, Work with Nuclear Radiation Sources and the Environment) are taught in the third period. At the end of the courses the participants present a Diploma Thesis. After this they can obtain from the national authority in the field (National Committee for the Control of the Nuclear Activities) the right to work with radioactive sources.*

- A similar course is taught at the Institute for Nuclear Physics and Engineering.

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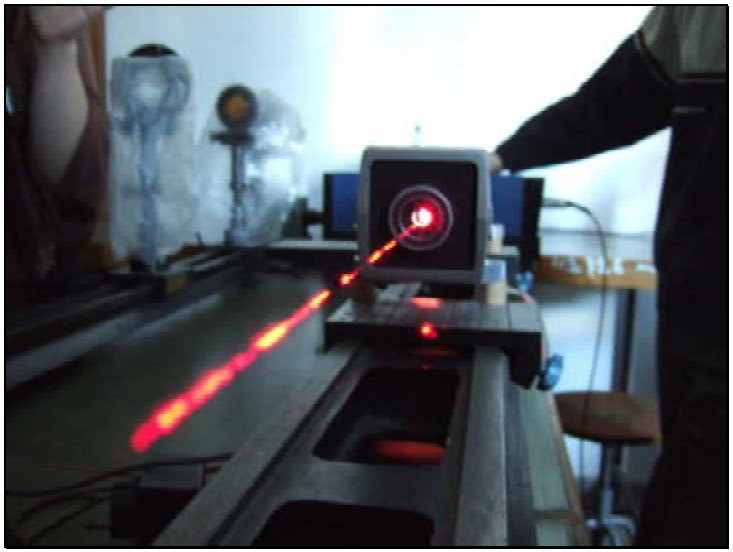

Research in Medical Physics

-Tomography – with X rays and γ rays (rotation-translation geometry, fun geometry and cone geometry)
-Boron therapy
- Radiation damages on tissues
- Elemental composition of tumors – PIXE, PIGME, neutron activation
- Correlations among the weights of different elements in some diseases
- Dynamic behaviour of the brain at different stimuli
- Others

Final remarks

Good teaching results are related to good scientific results of the teaching staff (the members of the Atomic and Nuclear Physics Chair published around 50 papers in Physics journals in each year and participate at many national and international conferences
- many problems related to the transition and the transition at the "Bologna style" concerning the students interests in study and research

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