Anexa 1 a planului de învățământ - rezultatele învățării

Programul de studii: **Physics of Atom, Nucleus, Elementary Particles, Astrophysics ans Applications 2026/2027**

Rezultate ale învăţării	Cunoștințe	Aptitudini	Responsabilitate şi autonomie	Discipline
R1	The student/graduate deeply understands the principles of atomic and nuclear physics, including theoretical models, methods, and experimental techniques.	The student/graduate applies theoretical concepts in various related fields (nuclear energy, high-energy physics, cosmology and astrophysics, nuclear medicine, radiation protection, and radiological hygiene).	The student/graduate plans and manages complex projects in atomic and nuclear physics, acting autonomously and responsibly in decision-making.	DOB.101.PAN Statistical Quantum Physics, DOB.102.PAN Interactions of the ionizing particles with matter, DOB.103.PAN Groups theory and applications in Physics, DOB.108.PAN Radiation sources, dosimetry, and radiological protection, DOP.106.1.PAN Radionuclides, environmental radioactivity, and nuclear waste management
R2	The student/graduate knows the mechanisms of radiation interaction with matter, the operating principles of the main classes of detectors, and their applications in technological and medical fields.	The student/graduate uses radiation detection and measurement systems, adapted to various applications (medical, industrial, and fundamental research).	The student/graduate efficiently organizes professional activities and working time in accordance with the pursued objectives.	DOB.102.PAN Interactions of the ionizing particles with matter, DOB.108.PAN Radiation sources, dosimetry, and radiological protection, DOB.109.PAN Medical and Nuclear Electronics, DOP.106.1.PAN Radionuclides, environmental radioactivity, and nuclear waste management, DOP.106.2.PAN Applications of Nuclear Physics in life sciences and medicine
R3	The student/graduate knows and understands the operating principles	The student/graduate collects and interprets data obtained through	The student/graduate analyzes experimental data and extracts relevant	DOB.102.PAN Interactions of the ionizing particles with matter, DOP.106.2.PAN Applications of

	and applicability of fundamental equipment used in each subfield of atomic and nuclear physics.	scientific methods, integrating the results within an analytical framework.	information about the quantities of interest.	Nuclear Physics in life sciences and medicine, DOP.110.1.PAN Models for nuclear structure, nuclear and photonuclear reactions, DOP.111.1.PAN Detection methods in Physics of atom, nucleus, elementary particles, and Astrophysics, DOB.201.PAN Relativistic nuclear Physics. Anomal states and phase transitions in nuclear matter
R4	The student/graduate knows the fundamental concepts of dosimetry as well as the principles and rules of radiological protection.	The student/graduate applies and evaluates safety and radiological protection regulations, applicable in educational and research laboratories.	The student/graduate takes responsibility for complying with radiological protection norms and ethical standards in multidisciplinary teams.	DOB.102.PAN Interactions of the ionizing particles with matter, DOB.108.PAN Radiation sources, dosimetry, and radiological protection, DOP.106.1.PAN Radionuclides, environmental radioactivity, and nuclear waste management, DOP.106.2.PAN Applications of Nuclear Physics in life sciences and medicine, DFA.113.PAN Nuclear archaeology
R5	The student/graduate has advanced knowledge of the behavior of radionuclides in the environment, as well as of the natural and anthropogenic processes that influence environmental radioactivity.	The student/graduate uses sampling, analysis, and data interpretation methods for radioactive contamination, including spectrometry and dosimetry techniques applied in environmental contexts.	The student/graduate complies with safety and radiation protection regulations, taking responsibility for risk assessment and the protection of the environment and public health.	DOB.102.PAN Interactions of the ionizing particles with matter, DOB.108.PAN Radiation sources, dosimetry, and radiological protection, DOP.106.1.PAN Radionuclides, environmental radioactivity, and nuclear waste management, DOP.106.2.PAN Applications of Nuclear Physics in life

				sciences and medicine, DOP.203.1.PAN Nuclear fission and fusion. Nuclear reactors and nuclear energetics
R6	The student/graduate understands the fundamental concepts of modern cosmology and astrophysics, including the structure and evolution of the Universe, galaxy formation, and primordial nucleosynthesis.	The student/graduate analyzes and interprets data from observations and numerical simulations, using theoretical models to describe cosmological and astrophysical phenomena.	The student/graduate demonstrates initiative and autonomy in exploring topics in cosmology and astrophysics, contributing to research or science outreach activities, and integrating acquired knowledge in interdisciplinary contexts.	DOB.101.PAN Statistical Quantum Physics, DOB.202.PAN Elementary particles phenomenology. Elements of Cosmology and astroparticle Physics., DOP.203.2.PAN Radioactive beams, nuclear bosonic condensation, and new types of nuclei , DOP.209.2.PAN Plasma physics in the study of nuclear, astrophysical, and cosmological processes
R7	The student/graduate knows the operating principles and applications of specialized software for modeling atomic and nuclear processes and for analyzing experimental and simulated data.	The student/graduate uses computing codes or software packages for research topics and specific applications.	The student/graduate demonstrates autonomy in using and developing computing programs, taking responsibility for respecting licensing norms and collaborative practices typical of open-source code development.	DOB.108.PAN Radiation sources, dosimetry, and radiological protection, DOP.106.1.PAN Radionuclides, environmental radioactivity, and nuclear waste management, DOP.106.2.PAN Applications of Nuclear Physics in life sciences and medicine, DOP.110.1.PAN Models for nuclear structure, nuclear and photonuclear reactions, DOP.110.2.PAN Experimental physics of heavy-ions at low energies
R8	The student/graduate knows advanced concepts in nuclear physics, elementary particles, astrophysics, and	The student/graduate uses modern methods of analysis and numerical simulation, integrating efficiently in	The student/graduate participates actively and responsibly in international projects, respecting the scientific, ethical, and	DOB.101.PAN Statistical Quantum Physics, DOB.103.PAN Groups theory and applications in Physics, DOB.105.PAN Research activity practice, DOP.111.1.PAN Detection

	cosmology.	international teams and contributing to frontier research in the field.	collaborative standards of the fundamental physics research community.	methods in Physics of atom, nucleus, elementary particles, and Astrophysics, DOP.111.2.PAN Large experiments in Nuclear Physics, Particle Physics and Astrophysics
R9	The student/graduate has in-depth knowledge of the mechanisms of nuclear fission and fusion processes, nuclear structure models, and their applications in energy and technology.	The student/graduate is capable of analyzing and comparing different nuclear processes, using theoretical models and computational tools to evaluate nuclear reactions and energy production.	The student/graduate can participate in projects concerning the sustainable development of nuclear energy sources, taking responsibility for evaluating the scientific, technological, and ethical impact of adopted decisions.	DOP.110.1.PAN Models for nuclear structure, nuclear and photonuclear reactions, DOP.203.1.PAN Nuclear fission and fusion. Nuclear reactors and nuclear energetics, DFA.210.PAN Complements of nuclear and photonuclear reactions, DOB.105.PAN Computational Methods for Atomic and Nuclear Physics Modelling
R10	The student/graduate should know the norms and ethical principles regarding scientific research in the field, as well as develop a culture of responsibility in intellectual work.	The student/graduate should assimilate explicit norms (normative texts) or implicit ones (customs, practices) that regulate academic and research conduct in the field.	The student/graduate should demonstrate solidarity, responsiveness, and support for strengthening academic integrity.	DOB.104.PAN Ethics and academic integrity, DOB.105.PAN Research activity practice, DOP.110.2.PAN Experimental physics of heavy-ions at low energies, DFA.113.PAN Nuclear archaeology, DOB.206.PAN Research activity practice
R11	The student/graduate should know the principles of communication and collaboration in multidisciplinary teams and the hierarchical structure specific to organizations.	The student/graduate should apply effective communication and coordination techniques in diverse teams, managing tasks and professional relationships at various hierarchical	The student/graduate should apply effective communication and coordination techniques in diverse teams, managing tasks and professional relationships at various hierarchical levels.	DOB.105.PAN Research activity practice, DOB.108.PAN Radiation sources, dosimetry, and radiological protection, DOP.110.2.PAN Experimental physics of heavy-ions at low energies, DFA.107.PAN Volunteering, DFA.114.PAN Volunteering

		levels.		

Anexa 2 a planului de învățământ - matricea rezultatelor învățării

Disciplina \ Rezultat	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	Nr rez
Statistical Quantum Physics	X					X		X				**3**
Interactions of the ionizing particles with matter	X	X	X	X	X							**5**
Groups theory and applications in Physics	X							X				**2**
Ethics and academic integrity										X		**1**
Computational Methods for Atomic and Nuclear Physics Modelling		X		X			X		X			**4**
Radionuclides, environmental radioactivity, and nuclear waste management	X	X		X	X		X					**5**
Applications of Nuclear Physics in life sciences and medicine		X	X	X	X		X					**5**
Volunteering											X	**1**
Radiation sources, dosimetry, and radiological protection	X	X		X	X		X				X	**6**
Medical and Nuclear Electronics		X										**1**
Models for nuclear structure, nuclear and photonuclear reactions	X	X	X				X		X			**5**
Experimental physics of heavy-ions at low energies	X						X			X	X	**4**
Detection methods in Physics of atom, nucleus, elementary particles, and Astrophysics	X	X	X				X	X				**5**
Large experiments in Nuclear Physics, Particle Physics and Astrophysics	X	X					X	X				**4**
Simulation codes in Nuclear Physics							X	X				**2**

Nuclear archaeology	X	X		X			X	X		X		**6**
Volunteering											X	**1**
Relativistic nuclear Physics. Anomal states and phase transitions in nuclear matter	X		X				X	X				**4**
Elementary particles phenomenology. Elements of Cosmology and astroparticle Physics.		X	X			X	X					**4**
Nuclear fission and fusion. Nuclear reactors and nuclear energetics	X	X			X		X	X	X			**6**
Radioactive beams, nuclear bosonic condensation, and new types of nuclei	X		X			X		X				**4**
Nuclear magnetic resonance. Physical principles and applications	X						X					**2**
Atomic and molecular clusters	X						X					**2**
Volunteering											X	**1**
Research activity practice								X		X	X	**3**
Research activity and Dissertation thesis preparation								X		X	X	**3**
Spectroscopic methods and techniques for investigation of the nuclear and subnuclear systems	X		X									**2**
Properties of atomic and molecular systems. Experimental models and techniques	X						X					**2**
Lasers, plasma, and acceleration methods. Experimental applications at ELI-NP	X	X	X				X					**4**
Plasma physics in the study of nuclear, astrophysical, and cosmological processes	X					X		X				**3**

Complements of nuclear and photonuclear reactions	X						X	X	X			**4**
Current experimental problems in Atomic and Nuclear Physics	X						X	X				**3**
Nuclear security	X	X	X	X	X					X		**6**
Volunteering											X	**1**
Total	**22**	**14**	**10**	**7**	**6**	**4**	**19**	**14**	**4**	**6**	**8**	