Radmile Matejčić 2 · 51000 Rijeka · Hrvatska
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I. OSNOVNI PODACI O KOLEGIJU						
Naziv predmeta	Nuklearna Fizika					
Akademska godina	2020./2021.					
Studijski program	Diplomski studij fizike	***Smjer***				
Status predmeta	Eligible/not mandatory	***Godina***	1	***Semestar***	2	

BODOVNA VRIJEDNOST I NAČIN IZVOĐENJA NASTAVE	***ECTS koeficijent opterećenja studenta***	***Broj sati (P+V+S)***
	6	30+15+15

NASTAVNICI / LABORANTI	***Ime i prezime***	***Kontakt (email, telefon)***
Nositelj predmeta	Marina Manganaro	marina.manganaro@uniri.hr 584 644
Asistent		

ODRŽAVANJE NASTAVE	***Vrijeme***	***Učionica***
Predavanja	Tuesday, 13:00-15:00	O-161
Vježbe	Friday, 14:00-15:00	O-161
Seminar/Praktikum	Friday, 15:00-16:00	O-161

KONZULTACIJE	***Vrijeme***	***Ured***
Nositelj predmeta	Always (drop an email before)	O-S12
Asistent		

II. POPIS TEMA - PREDAVANJA			
Tjedan	***Datum***	***Sati***	***Tema***
1.		2	Historical perspective. Rutherford scattering fomula; properties of the Rutherford differential cross-section; the nuclear constituents
		2	The experiments of Rutherford
2.		2	The scale of nuclear physics and suitable units; the radioactive decay law; multimodal decays; decay and uncertainty principle; collisions and cross-sections;
		2	The production of radioactive material; radioactive dating
3.		2	The scattering of electrons by nuclei; the nuclear electric charge distribution; the nuclear electric form-factor; the isotope shift; X-ray spectroscopy of mu-mesic atoms; nuclear scattering and nuclear size
		2	The size and shape of nuclei
4.		2	The naturally occuring nuclei; the nuclear binding energy; the Coulomb and asymmetry terms;
		2	The masses of nuclei

5.		2	Nuclear decay; energy-level diagrams; the stability of nuclei; spontanous fission; transitions rates;
		2	More on beta-decay
6.		2	Alpha-decay and its properties; the simple theory of Coulomb barrier penetration; the angular momentum barrier; decay schemes involving alpha-particle emission; barriers in other decays;
		2	Cloud chamber
7.		2	Nuclear collisions and interactions; kinematics of nuclear collisions; nuclear spectroscopy; compound state to direct; elastic scattering;
		2	Reactions induced by heavy ions
8.		2	Magic numbers; shell model; the spin-orbit interaction; the spin and parities of nuclear ground states; electromagnetic moments: magnetic and electric quadrupole;
		2	
9.		2	Forces and interactions; electromagnetism; the Dirac equation; Feynman diagrams; tests of QED; nuclear forces; the bound two-nucleon system; the unbound nucleon system; the Yukawa theory; Quarks, gluons, and QCD; the strong interaction; the weak interaction;
		2	Overview of fundamental interactions
10.		2	astrophysics students: The expanding Universe environmental physics students: Nuclear power;
		2	Seminars by students on dedicated topics
11.		2	astrophysics students: Big Bang nucleosynthesis environmental physics students: Four factor formula; reactor equations; stationary reactor
		2	Seminars by students on dedicated topics
12.		2	astrophysics students: Stellar evolution; stellar nucleosynthesis environmental physics students: Radiation and health; norms on exposure to radiation
		2	Seminars by students on dedicated topics
13.		2	astrophysics students: Neutrinos in stellar evolution; supernovae environmental physics students: Normal use of nuclear power; waste management; uranium mines; enrichment
		2	Seminars by students on dedicated topics
14.		4	Visit to Elektra synchrotron Basovizza (if allowed by epidemiologic situation: otherwise a virtual visit to a facility will be organized)
15.		4	Visit to Ruđer Bošković Institute (if allowed by epidemiologic situation: otherwise a virtual visit to a facility will be organized)

III. SUSTAV OCJENJIVANJA

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Aktivnost koja se ocjenjuje	***Udio aktivnosti u ECTS bodovima***	***Maximalan broj bodova***
Active participation	2	30
Homework	0.5	10
Public seminar	1.5	20
Final exam	2	40
Total	6	100

OPISI AKTIVNOSTI KOJE SE OCJENJUJU

IV. DODATNE INFORMACIJE O PREDMETU

Pohađanje nastave

Pridržavanje dogovorenih rokova

Ostale relevantne informacije

Expected outcomes:
Having passed the exam, the students will be capable of:
1) Explain the cross-section of different nuclear processes
2) Describe the different models of nuclei
3)Explain basic concepts such as probability density, expected values, variance
4) Use suitable units in nuclear physics to solve simple problems
5) Describe used experimental techniques and measuring instruments used in nuclear physics
6) Explain the theoretical principles on which the experimental techniques and measuring instruments used are based

Reference books
-W. S. C. Williams, Nuclear and Particle Physics, Oxford Physics
-K. S. Krane, Introductory Nuclear Physics, Wiley
Supplementary literature
-L. Valentin, Subatomic Physics: Nuclei and Particles, Hermann
-G. F. Knoll, Radiation detection and measurement, Wiley