

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)						
<b>Predmet:</b>		Moderna fizika				
<b>Course title:</b>		Modern physics				
<b>Študijski program in stopnja</b>		<b>Študijska smer</b>		<b>Letnik</b>		<b>Semester</b>
<b>Study programme and level</b>		<b>Study field</b>		<b>Academic year</b>		<b>Semester</b>
Magistrski študijski program Matematika		ni smeri		1 ali 2		prvi ali drugi
Master's study programme Mathematics		none		1 or 2		first or second
<b>Vrsta predmeta / Course type</b>				izbirni / elective		
<b>Univerzitetna koda predmeta / University course code:</b>				M2725		
<b>Predavanja</b>	<b>Seminar</b>	<b>Vaje</b>	<b>Klinične vaje</b>	<b>Druge oblike</b>	<b>Samost. delo</b>	<b>ECTS</b>
<b>Lectures</b>	<b>Seminar</b>	<b>Tutorial</b>	<b>work</b>	<b>študija</b>	<b>Individ. work</b>	
45		30			105	6
<b>Nosilec predmeta / Lecturer:</b>				prof. dr. Svjetlana Fajfer, prof. dr. Peter Križan		
<b>Jeziki / Languages:</b>		<b>Predavanja / Lectures:</b> slovenski / Slovene, angleški / English				
		<b>Vaje / Tutorial:</b> slovenski / Slovene, angleški / English				
<b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b>				<b>Prerequisites:</b>		
Vpis v letnik študija.				Enrolment in the programme.		
<b>Vsebina:</b>				<b>Content (Syllabus outline):</b>		

<p>Elektromagnetno polje:</p> <ul style="list-style-type: none"> <li>•Električna in magnetna polja,</li> <li>•Integralska in diferencialna oblika Maxwellovih enačb,</li> <li>•Elektromagnetno valovanje,</li> </ul> <p>Posebna teorija relativnosti:</p> <ul style="list-style-type: none"> <li>•Transformacija prostor-časa</li> <li>•Transformacije električnega in magnetnega polja, Maxwellove enačbe v kovariantni obliki</li> </ul> <p>Kvantna fizika:</p> <ul style="list-style-type: none"> <li>•Valovne lastnosti delcev,</li> <li>•Schrödingerjeva enačba in probabilistična interpretacija,</li> <li>•Postulati kvantne fizike, Heisenbergove relacije,</li> <li>•Harmonični oscilator,</li> <li>•Vodikov atom,</li> <li>•Standardni model osnovnih delcev: leptoni in kvarki, osnove umeritvenih teorij elektromagnetne, šibke in močne interakcije.</li> <li>•Modeli vesolja</li> </ul>	<p>Electromagnetic field:• Electric and magnetic fields,• Integral and differential form of Maxwell's equations,• Electromagnetic waves,Special theory of relativity:• Transformation of space-time</p> <ul style="list-style-type: none"> <li>• Transformations of electric and magnetic fields, covariant form of Maxwell's equations</li> </ul> <p>Quantum physics:• Wave properties of particles,• Schrödinger equation and the probabilistic interpretation,• Postulates of quantum physics, Heisenberg relations,• Harmonic oscillator,• Hydrogen atom, • The Standard Model of elementary particles: quarks and leptons, the basics of gauge theories of electromagnetic, weak and strong interactions. • Models of the Universe</p>
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**Temeljna literatura in viri / Readings:**

J. Strnad: Fizika 3 in Fizika 4  
 J. Vanderlinde, Classical electromagnetic theory, Wiley, New York, 1993  
 F. Schwabl, Quantum Mechanics, Springer, Berlin, 1991

**Cilji in kompetence:**

Študent spozna osnovne zakonitosti na področju klasične elektrodinamike, posebne teorije relativnosti, kvantne fizike, fizike osnovnih delcev, ter modelov vesolja. Predmetno specifične kompetence: poznavanje in razumevanje konstrukcije teorije elektromagnetnega polja, posebne teorije relativnosti kvantne fizike in interakcij med osnovnimi delci. Sposobnost za reševanje konkretnih problemov s teh področij. Sposobnost povezovanja teoretičnih napovedi in meritev. Kritično ovrednotenje in uporaba novih spoznanj na področju moderne fizike.

**Objectives and competences:**

Students learn about the basic laws of classical electrodynamics, special relativity, quantum physics, elementary particle physics, as well as models of the universe.

Subject-specific competencies: knowledge and understanding of the of electromagnetic field theory, special theory of relativity and quantum physics interactions between elementary particles and their bound states, the ability to solve practical problems in these areas, the ability to link the theoretical predictions and measurements, critical evaluation and application of new knowledge in the field of modern physics.

**Predvideni študijski rezultati:**

Znanje in razumevanje: Pridobitev osnovnega znanja teorij moderne fizike. Sposobnost povezovanja teoretičnih napovedi in meritev.

Uporaba: Razumevanje fizikalnih zakonitosti moderne fizike in vloge matematičnih pristopov.

Refleksija: Kritično ovrednotenje teoretičnih napovedi z rezultati meritev.

Prenosljive spretnosti – niso vezane le na en predmet: Sposobnost razumevanja pojavov ter razlaganja in vrednotenja rezultatov meritev.

**Intended learning outcomes:**

Knowledge and understanding: Acquire basic knowledge on theories of modern physics. The ability to link the theoretical predictions and measurements.

Application: Understanding of the laws of modern physics and applications of mathematical approaches.

Reflection: A critical assessment of the theoretical predictions with the results of the measurements.

Transferable skills: Ability to understand the phenomena and the interpretation and evaluation of the results of measurements.

**Metode poučevanja in učenja:****Learning and teaching methods:**

predavanja, vaje, domače naloge, konzultacije, seminarji	Lectures, exercises, homeworks, consultations, seminars
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Delež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
izpit iz vaj (2 kolokvija ali pisni izpit)		2 midterm exams instead of written exam, written exam
ustni izpit	50%	oral exam
Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50%	Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

**Reference nosilca / Lecturer's references:**

Peter Križan:

Belle Collaboration, HARA, K., BRAČKO, Marko, GOLOB, Boštjan, KLUČAR, Jure, KORPAR, Samo, KRIŽAN, Peter, PESTOTNIK, Rok, PETRIČ, Marko, SMERKOL, Peter, STARIČ, Marko, ZUPANC, Anže, et al. Evidence for  $B^0 \rightarrow \tau^+ \nu_\tau$  with a hadronic tagging method using the full data sample of Belle. Physical review letters, ISSN 0031-9007. [Print ed.], 2013, vol. 110, no. 13, str. 131801-1-131801-6. [COBISS.SI-ID 27055911]

Belle Collaboration, ADACHI, Ichiro, BRAČKO, Marko, GOLOB, Boštjan, KORPAR, Samo, KRIŽAN, Peter, PESTOTNIK, Rok, PETRIČ, Marko, SMERKOL, Peter, STANIČ, Samo, STARIČ, Marko, ZUPANC, Anže, et al. Precise measurement of the CP violation parameter  $\sin^2 \phi_1$  in  $B^0 \rightarrow c \bar{c} K^0$  decays. Physical review letters, ISSN 0031-9007. [Print ed.], 2012, vol. 108, no. 17, str. 171802-1-171802-7. [COBISS.SI-ID 25989415]

KRIŽAN, Peter. Overview of particle identification techniques. V: TRDs for the Third Millenium : proceedings of the 4th Workshop on Advanced Transition Radiation Detectors for Accelerators and Space Application, September 14-16, 2011, Bari, Italy, (Nuclear instruments and methods in physics research, ISSN 0168-9002, A, Accelerators, spectrometers, detectors and associated equipment, Vol. 706, 2013). Amsterdam: Elsevier, 2013, vol. 706, str. 48-54. [COBISS.SI-ID 27083559]

Svjetlana Fajfer:

Svjetlana Fajfer:

FAJFER, Svjetlana, KAMENIK, Jernej, NIŠANDŽIĆ, Ivan.  $B \rightarrow D^{*} \tau \nu$  sensitivity to new physics. Physical review. D, Particles, fields, gravitation, and cosmology, ISSN 1550-7998, 2012, vol. 85, no. 9, str. 094025-1-094025-9. [COBISS.SI-ID 25811495]

DORŠNER, Ilja, FAJFER, Svjetlana, KAMENIK, Jernej, KOŠNIK, Nejc. Light colored scalars from grand unification and the forward-backward asymmetry in  $t \bar{t}$  production. Physical review. D, Particles, fields, gravitation, and cosmology, ISSN 1550-7998, 2010, vol. 81, no. 5, str. 055009-1-055009-11. [COBISS.SI-ID 23517735]

FAJFER, Svjetlana, KAMENIK, Jernej, NIŠANDŽIĆ, Ivan, ZUPAN, Jure. Implications of lepton flavor universality violations in B decays. Physical review letters, ISSN 0031-9007. [Print ed.], 2012, vol. 109, issue 16, str. 161801-1-161801-5. [COBISS.SI-ID 26186535]