

UČNI NAČRT PREDMETA / COURSE SYLLABUS						
Predmet:		Moderna fizika				
Course title:		Modern physics				
Študijski program in stopnja Study programme and level		Študijska smer Study field		Letnik Academic year	Semester Semester	
Magistrski študijski program Matematika		ni smeri		1 ali 2	prvi ali drugi	
Master's study programme Mathematics		none		1 or 2	first or second	
Vrsta predmeta / Course type				izbirni		
Univerzitetna koda predmeta / University course code:				M2725		
Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		30			105	6
Nosilec predmeta / Lecturer:		prof. Peter Križan, prof. Svjetlana Fajfer				
Jeziki / Languages:		Predavanja / Lectures: slovenski/Slovene, angleški/English				
		Vaje / Tutorial: slovenski/Slovene, angleški/English				
Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:				Prerequisites:		
Vsebina:				Content (Syllabus outline):		
Elektromagnetno polje: •Električna in magnetna polja, •Integralska in diferencialna oblika				Electromagnetic field:• Electric and magnetic fields,• Integral and differential form of Maxwell's equations,• Electromagnetic waves,Special theory of relativity:•		

<p>Maxwellovih enačb,</p> <ul style="list-style-type: none"> • Elektromagnetno valovanje, <p>Posebna teorija relativnosti:</p> <ul style="list-style-type: none"> • Transformacija prostor-časa • Transformacije električnega in magnetnega polja, Maxwellove enačbe v kovariantni obliki <p>Kvantna fizika:</p> <ul style="list-style-type: none"> • Valovne lastnosti delcev, • Schrödingerjeva enačba in probabilistična interpretacija, • Postulati kvantne fizike, Heisenbergove relacije, • Harmonični oscilator, • Vodikov atom, • Standardni model osnovnih delcev: leptoni in kvarki, osnove umeritvenih teorij elektromagnetne, šibke in močne interakcije. • Modeli vesolja 	<p>Transformation of space-time</p> <ul style="list-style-type: none"> • Transformations of electric and magnetic fields, covariant form of Maxwell's equations <p>Quantum physics:</p> <ul style="list-style-type: none"> • 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
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Temeljni literatura in viri / Readings:

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

<p>Študent spozna osnovne zakonitosti na področju klasične elektrodinamike, posebne teorije relativnosti, kvantne fizike, fizike osnovnih delcev, ter modelov vesolja.</p>
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Objectives and competences:

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

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.

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:

predavanja, vaje, domače naloge, konzultacije, seminarji

Learning and teaching methods:

Lectures, exercises, homeworks, consultations, seminars

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Način (pisni izpit, ustno izpraševanje,

50%

Type (examination, oral, coursework,

naloge, projekt): izpit iz vaj (2 kolokvija ali pisni izpit) ustni izpit Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50%	project): 2 midterm exams instead of written exam, written exam oral exam Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)
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Reference nosilca / Lecturer's references:

Svjetlana Fajfer:

- 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. $B \rightarrow D^* \tau \nu$ 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]
- 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]

Peter Križan:

- 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]
- 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 $B^* \rightarrow \tau^* (\nu\bar{\nu})$ 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]
- 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

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