



### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Kvantna mehanika
<b>Course name:</b>	Quantum mechanics

Študijski program in stopnja Study program and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika in Astrofizika I. stopnja	/	2	2
Physics and Astrophysics I. level	/	2	2

<b>Vrsta predmeta / Course type</b>	obvezni / mandatory
<b>Univerzitetna koda predmeta / University course code:</b>	1FAF17

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Lab. work	Teren. vaje Field work	Samost. delo Indiv. work	ECTS
45	/	45	/	/	180	9

<b>Nosilec predmeta / Lecturer:</b>	Prof. dr. Giovanni De Ninno	
<b>Jeziki / Languages:</b>	<b>Predavanja / Lectures:</b>	slovenščina / English
	<b>Vaje / Tutorial:</b>	slovenščina / English

**Pogoji za opravljanje študijskih obveznosti: Prerequisites:**

Fizika 1, Analiza 1	Physics 1, Analysis 1
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Vsebina:	Syllabus outline:
<p>Povezava s posebno teorijo relativnosti. Konec klasičnega obdobja. Koncept kvanta. Valovanje snovi. Dualnost valovanja-delcev. Schrödingerjeva enačba. Primer neskončnega potencialnega praga. Harmonski oscilator. Tunelski efekt. Heisenbergov princip nedoločenosti. Komutirajoče/nekmutirajoče spremenljivke. Vodikov atom. Kvantizacija vrtilne količine. Spin elektrona. Spinsko-magnetna interakcija. Zeemanov pojav. Paulijevo načelo izključevanja. Fermijoni in bozoni. Statistična kvantna mehanika.</p>	<p>Interaction to special relativity. The end of the classical period. The concept of quanta. Matter waves. The wave-particle duality. The Schrödinger equation. The case of infinite potential step. The harmonic oscillator. The tunnel effect. Heisenberg's uncertainty relations. Commuting observables and compatible variables. The hydrogen atom. Quantization of the angular momentum. Electron spin. The spin magnetic moment. The Zeeman effect. The Pauli exclusion principle. Fermions and bosons. Quantum statistical mechanics.</p>



**Temeljni literatura in viri / Basic readings:**

1. D. Griffiths: Introduction to quantum mechanics (ed. Cambridge) + lectures notes

**Cilji in kompetence:**

Posreduje pregled osnovnih principov posebne teorije relativnosti in kvantne mehanike: od zaključka obdobja klasičnega opisa do kvanta.

**Objectives and competences:**

Provide an overview of basic principles of special relativity and quantum mechanics: from the end of classical period to quanta.

**Predvideni študijski rezultati:**

Sposobnost razumevanja in reševanja osnovnih problemov kvantne mehanike, modeliranih s pomočjo časovno neodvisne Schrödingerjeve enačbe.

**Intended learning outcomes:**

Capability of understanding and solving basic problems in quantum mechanics, modeled through the time-independent Schrödinger equation.

**Metode poučevanja in učenja:**

- - kolokviji, pisni izpit
- - ustni izpit

**Learning and teaching methods:**

50  
50

**Načini ocenjevanja:**

- kolokviji, pisni izpit
- ustni izpit

**Utež / Weight (%)**

50  
50

**Assessment:**

- written tests, written exam
- oral exam

**Reference nosilca / references of the course principal:**

Prof. dr. Giovanni De Ninno je redni profesor za področje fizike na Univerzi v Novi Gorici. Professor Giovanni De Ninno is a full professor of physics at the University of Nova Gorica.

1. ALLARIA, E., DE NINNO, Giovanni, GAUTHIER, David, et al. Two-colour pump-probe experiments with a twin-pulse-seed extreme ultraviolet free-electron laser. *Nature communications*, ISSN 2041-1723, maj 2013, vol. 4, str. 1-7, doi: [10.1038/ncomms3476](https://doi.org/10.1038/ncomms3476). [COBISS.SI-ID [2887163](https://www.cobiss.si/id/2887163)]
2. ALLARIA, Enrico, DE NINNO, Giovanni, GAUTHIER, David, SPAMPINATI, Simone, et al. Two-stage seeded soft-X-ray free-electron laser. *Nature photonics*, ISSN 1749-4885, 2013, vol. 7, no. 11, str. 913-918, doi: [10.1038/nphoton.2013.277](https://doi.org/10.1038/nphoton.2013.277). [COBISS.SI-ID [2928379](https://www.cobiss.si/id/2928379)]
3. DE NINNO, Giovanni, MAHIEU, Benoît, ALLARIA, E., GIANNESI, L., SPAMPINATI, S. Chirped seeded free-electron lasers : self-standing light sources for two-color pump-probe experiments. *Physical review letters*, ISSN 0031-9007. [Print ed.], 2013,



vol. 110, no. 6, str. 064801-1-064801-5, doi: [10.1103/PhysRevLett.110.064801](https://doi.org/10.1103/PhysRevLett.110.064801).  
[COBISS.SI-ID [2882299](#)]

4. 4. ALLARIA, E., DE NINNO, Giovanni, et al. Highly coherent and stable pulses from the FERMI seeded free-electron laser in the extreme ultraviolet. *Nature photonics*, ISSN 1749-4885, 2012, vol. 6, no. 10, str. 699-704, doi: [10.1038/nphoton.2012.233](https://doi.org/10.1038/nphoton.2012.233). [COBISS.SI-ID [2817787](#)]
5. 5. DE NINNO, Giovanni, FANELLI, Duccio, Out-of-equilibrium statistical ensemble inequivalence. *Europhysics letters*, ISSN 0295-5075, 2012, vol. 97, no. 2, str. 20002-p1-20002-p5, doi: [10.1209/0295-5075/97/20002](https://doi.org/10.1209/0295-5075/97/20002). [COBISS.SI-ID [2883323](#)] [COBISS.SI-ID2620155]