



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Atomska fizika
Course title:	Atomic physics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA		1. ali 2.	1., 2. ali 3.
PHYSICS		1. or 2.	1., 2. or 3.

Vrsta predmeta / Course type

Izbirni za modul Biofizika 3, Fizika 1, 2 in 3

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
10	5				435	15

Nosilec predmeta / Lecturer:

Jana Padežnik Gomilšek

Jeziki /

Languages:

Predavanja /

Lectures:

Vaje / Tutorial:

slovenski/Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

poznavanje osnov kvantne mehanike

Prerequisites:

preknowledge of quantum mechanics

Vsebina:

- atom z enim elektronom (vodikov atom, centralno polje, elektronska stanja, razcep nivojev, prehodi s sevanjem, fotoionizacija, vodiku podobni atomi)
- atom z dvema elektronom (Paulijev princip, simetrije valovnih funkcij,

Content (Syllabus outline):

- one-electron atom (hydrogen atom, central field, electronic states, splitting of levels, radiative transitions, photoionization, hydrogen-like ions)
- two-electron atom (Pauli principle, symmetry of atomic wave-functions, self-

samousklajeno polje)

- lahki atomi (lupinski model, sklopitve, fina struktura)
- težji atomi (sheme za seštevanje vrtilnih količin, korelacije in skupinski učinki)
- vzbujeni atomi in ioni
- programski paketi za atomske izračune

consistent field)

- light atoms (shell model, coupling, fine structure)
- heavy atoms (coupling schemes, correlations and collective effects)
- excited atoms and ions
- program packages for atomic calculations

Temeljni literatura in viri / Readings:

- 1) R. D. Cowan: The theory of atomic structure and spectra, University of California Press, 1981
- 2) B. M. Smirnov, Physics of atoms and ions, Springer, 2003
- 3) K. G. Dyall: GRASP – Users' Manual, Oxford, 1988
- 4) W.R. Johnson: Atomic Structure Theory, Lectures on Atomic Physics, Springer, 2007.
- 5) D. Budker: Atomic physics: An exploration through problems and solutions, Oxford University Press, 2008.

Cilji in kompetence:

Študentje pridobijo poglobljeno razumevanje zgradbe in lastnosti atoma ter procesov v atomu.

Objectives and competences:

Students obtain deep understanding of atomic structure, properties of atoms and atomic processes.

Predvideni študijski rezultati:

Znanje in razumevanje:

Študentje razumejo principe metod za izračunavanje energij elektronskih stanj v atomih in verjetnosti za prehode, poznajo območja veljavnosti posameznih približkov, znajo izbrati ustrezno metodo in interpretirati rezultate.

Prenesljive/ključne spretnosti in drugi atributi:

Razumevanje atomskih procesov, kritičen odnos do uporabe posameznih približkov, poznavanje in uporaba programskih paketov.

Intended learning outcomes:

Knowledge and understanding:

Students understand concepts of methods for calculation of energies of electronic states and transition probabilities in atoms, they are acquainted with reliability range of respective methods, they are able to select the appropriate method and interpret the results.

Transferable/Key Skills and other attributes:

Understanding of atomic processes, critical attitude to use of respective approximations, acquaintance with program packages and their use.

Metode poučevanja in učenja:

Predavanja

Seminarska naloga

Learning and teaching methods:

Lectures

Seminar work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Seminarska naloga	50 %	Seminar work
Ustni izpit	50 %	Oral exam

Reference nosilca / Lecturer's references:

1. HAUKO, Robert, PADEŽNIK GOMILŠEK, Jana, ARČON, Iztok, KODRE, Alojz. Absolute determination of the X-ray absorption coefficient of strontium in the K edge region. *Radiation physics and chemistry*, ISSN 0969-806X. [Print ed.], Oct. 2014, vol. 103, str. 203-208. <http://www.sciencedirect.com/science/article/pii/S0969806X14002424#>, doi: [10.1016/j.radphyschem.2014.05.059](https://doi.org/10.1016/j.radphyschem.2014.05.059). [COBISS.SI-ID 17976854]
2. PADEŽNIK GOMILŠEK, Jana, KODRE, Alojz, ARČON, Iztok, DE PANFILIS, Simone, MAKOVEC, Darko. Atomic absorption background of Ba in EXAFS analysis of BaFe₁₂O₁₉ nanoparticles. *Journal of synchrotron radiation*, ISSN 0909-0495, 2011, vol. 18, issue 4, str. 557-563, doi: [10.1107/S0909049511010181](https://doi.org/10.1107/S0909049511010181). [COBISS.SI-ID 2335844]
3. PADEŽNIK GOMILŠEK, Jana, KODRE, Alojz, ARČON, Iztok, BRATINA, Gvido. X-ray absorption of cadmium in the L-edge region. *Physical review. A, Atomic, molecular, and optical physics*, ISSN 1050-2947, 2011, vol. 84, issue 5, str. 052508-1-052508-7, doi: [10.1103/PhysRevA.84.052508](https://doi.org/10.1103/PhysRevA.84.052508). [COBISS.SI-ID 2375012]
4. KODRE, Alojz, PADEŽNIK GOMILŠEK, Jana, ARČON, Iztok, AQUILANTI, Giuliana. X-ray atomic absorption of cesium and xenon in L-edge region. *Physical review. A, Atomic, molecular, and optical physics*, ISSN 1050-2947, 2010, vol. 82, issue 2, str. 022513-1-022513-7. [COBISS.SI-ID 1539835]
5. PADEŽNIK GOMILŠEK, Jana, ARČON, Iztok, PANFILIS, S. de, KODRE, Alojz. X-ray absorption in atomic iodine in the K-edge region. *Physical review. A, Atomic, molecular, and optical physics*, ISSN 1050-2947, 2009, vol. 79, no. 3, str. 032514-1-032514-7. [COBISS.SI-ID 1075195]