

Study program	Level of studies		Third cycle	
	Title of the study program		Doctoral studies in physics	
Course title	PHYSICS OF ATOMS AND IONS			
Course ID	Semester	Course status	ECTS credits	Teaching hours
PTH7021	I /II	Elective	10	30
Course aims and expected learning outcomes	<p>The aim of the course is for students to deepen their knowledge of the physics of atoms and ions, quantum mechanical description of the states of hydrogen-like atoms and multi-electron atoms and ions. The student will master the concepts, phenomena and quantum mechanical apparatus of the physics of atoms and ions, and distinguish the models used for the quantum mechanical description of neutral atoms and ions. The student will also be familiar with the description of atoms in external fields.</p>			
COURSE CONTENT				
<p>Hydrogen atom. Fine level splitting. Lamb shift. Grotrian diagram.  Photoionization of a one-electron atom. Hydrogen-like atoms.  Two-electron atoms and ions. Pauli's principle and symmetry of the wave function. Self-consistent field for two-electron and multi-electron atoms and ions.  Light atoms. Scale model. Asymptotic wave function. Fine splitting of light atom levels.  Atoms and ions with valence s-electrons.  Atoms and ions with valence p-electrons. Structure of heavy atoms. Atoms with valence d and f electrons.  Thomas-Fermi model of the atom. Exchange effects. Schemes of summation of electronic moments in atoms. Correlation and collective effects.  Excited atoms. Meta-stable and resonantly excited atoms.  Generation and detection of meta-stable atoms. Generation and detection of highly excited atoms.  Positive and negative ions. Multiple ions. Electronic wave function of negative ions.  Photodetachment.</p>				
LITERATURE			ASSESSMENT OF LEARNING	
<p>- Boris M. Smirnov, <i>Physics of Atoms and Ions</i>, Springer, New York, 2003.</p> <p>- I. Supek, <i>Teorijska fizika i struktura materije</i>, II dio, Školska knjiga, Zagreb, 1977.</p> <p>- L. D. Landau, E. M. Lifšic, <i>Teoretičeskaja fizika. Tom III: Kvantovaja mehanika. Nereljativistkaja teorija</i>, Nauka, Moskva, 1989.</p> <p>- W. Greiner, <i>Quantum mechanics. Special chapters</i>, Springer, Berlin, 1998.</p>			Assessment Method	Points
			Homework	30
			Seminar paper	30
			Final exam	40
			Total	100
Remarks				