COURSE OFFERED

Name of the course	Polish	**Fizyka atomowa**
	English	**Atomic physics**

1 LOCATION OF THE COURSE WITHIN THE EDUCATION SYSTEM

1.1. Section [1]	Section of Exact and Natural Sciences
1.2. Discipline[2]	Physical Sciences
1.3. Type of education	Full-time
1.4. Level of education	Doctoral School (PQF Level 8)
1.5. Person preparing the course description	prof. dr hab. Marek Pajek
1.6. Contact	marek.pajek@ujk.edu.pl

2 GENERAL CHARACTERISTICS OF THE COURSE

2.1. Type of course [3]	Specialised subject in the discipline (elective)
2.2. Language of the course	English

3 DETAILED CHARACTERISTICS OF THE COURSE

3.1. Type of classes[4]		Lecture (L) and classes/seminars
3.2. Number of hours[5]		30 hours: 15 hours of lectures and 15 hours of classes/seminars
3.3. Location of classes		Classroom at Jan Kochanowski University in Kielce
3.4. Type of assessment		Oral exam including assessment of problem-solving tasks
3.5. Didactic methods		Problem-based lectures, derivations and worked examples; problem solving tasks
3.6. Literature	basic	W. Demtröder, *Atoms, Molecules and Photons*, Springer 2018
	supplementary	I.V. Hertel and C.-P. Schultz, *Atoms, Molecules and Optical Physics Vol.1: Atoms and Spectroscopy*, Springer 2015.

1 Sections: Humanities; Social Sciences; Exact and Natural Sciences; Medical and Health Sciences; Arts.

2 Discipline as specified in the curriculum of the Doctoral School.

3 General subjects; general subjects in the discipline; specialised subjects in the discipline.

4 Classes, lecture or seminar.

5 Consistent with the curriculum of the Doctoral School of Jan Kochanowski University in Kielce.

4 OBJECTIVES SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives (lecture)
C01 Explanation of selected advanced topics in atomic physics.
C02 Formal derivation and interpretation of crucial results for atomic physics.
C03 Methods of solving selected general problems in atomic physics.

4.2. Syllabus content (30 hours in total)
1. Nonrelativistic description of H-like atoms (Schrödinger equation)
2. Spin of electron and Schrödinger-Pauli equation (Thomas factor)
3. Relativistic Dirac equation and its solution for H-like atoms
4. QED effects and Lamb-shift
5. Multi-electron atoms (Ritz variational and Hartree-Fock methods)
6. Radiation of atoms (Einstein coefficients)
7. Selection rules (electric dipole transitions)
8. Linear and circular polarization of photons (Stokes parameters)
9. Nonradiative deexcitation of atoms (Auger-Meitner, Internal Dielectronic Excitation (IDE)and Interatomic Coulombic Decay (ICD)
10. Formation and relaxation of Rydberg Hollow atoms (RHA)

4.3 SUBJECT LEARNING OUTCOMES

Learning outcome	A doctoral student who has passed the course	Reference to Doctoral School learning outcomes
In the area of KNOWLEDGE		
W01	Knows basic problems related to electronic structure and deexcitation of atoms	SD_W01 SD_W02
W02	Knows general methods of description atomic structure and deexcitation processes.	SD_W07
In the area of SKILLS		
U01	Can derive the basic formula and calculate the selected characteristics of atoms and atomic processes.	SD_U01 SD_U03
U02	Uses scientific literature to extract necessary information on atomic physics.	SD_U07
In the area of SOCIAL COMPETENCE		
K01	Understands atomic origin of various process in nature	SD_K04

4.4 METHODS OF ASSESSMENT OF THE INTENDED LEARNING OUTCOMES

SUBJECT LEARNING OUTCOMES	METHOD OF ASSESSMENT (+ / -)																				
	Oral / ~~written~~ exam			Oral assessment			Project			Activity in class			Own work			Group work			Other		
	Type of classes			Type of classes			Type of classes			Type of classes			Type of classes			Type of classes			Type of classes		
	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S
W01	+	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
W02	+-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
U01	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
U02	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
K01	+-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

L = lecture; C = classes; S = seminar. + = method used; - = method not used.

The oral assessment covers conceptual questions and short calculations. English communication is assessed throughout. Class discussion and independent preparation verify the recognition of the value of knowledge and initiative in selecting an approach to a problem.

4.5 CRITERIA OF ASSESSMENT OF THE INTENDED LEARNING OUTCOMES

Form of classes	Grade	Criterion of assessment
Lecture (L)	3.0	When <50-60) % of required effects is achieved
	3.5	When <60-70) % of required effects is achieved
	4.0	When <70-80) % of required effects is achieved
	4.5	When <80-90) % of required effects is achieved
	5.0	When <90-100) % of required effects is achieved

Grade 2.0 (fail): fewer than 50% of the maximum points.

Accepted for implementation

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(date and signature of the lecturer)