A COURSE SYLLABUS – DOCTORAL SCHOOL

REGARDING THE QUALIFICATION CYCLE FROM 2020 TO 2024

GENERAL INFORMATION ABOUT COURSE	
Course title	PhD seminar
Name of the unit running the course	Doctoral School at University of Rzeszów
Type of course *(obligatory, optional)*	obligatory
Year and semester of studies	2021/2022; II year, s. III i IV 2022/2023; III year, s. V i VI 2024/2025; IV year, s. VII i VIII
Discipline	Physical sciences
Language of Course	English
Name of Course coordinator	Dr hab. Marta Łuszczak, prof. UR
Name of Course lecturer	Dr hab. Marta Łuszczak, prof. UR
Prerequisites	Knowledge of physics at the university level, in particular particle physics.

BRIEF DESCRIPTION OF COURSE
(100-200 words)

The doctoral seminar focuses on supporting the Phd student in the implementation of individual stages of scientific research, that are necessary for the preparation of a doctoral dissertation. The content of the subject is directly related to the topic of the doctoral dissertation, in particular, it concerns the study of photon-induced processes in the field of high-energy physics.

COURSE LEARNING OUTCOMES AND METHODS OF EVALUATING LEARNING OUTCOMES

Learning outcome	The description of the learning outcome defined for the course	Relation to the degree programme outcomes (symbol)	Learning Format (Lectures, classes,...)	Method of assessment of learning outcomes (e.g. test, oral exam, written exam, project,...)
Knowledge (no.)	**(Knows and understands)**			
K1	Understands the context of the study of elementary particles in relation to other research in physics and can evaluate promising directions of research.	P8S-WG/1, P8S-WG/2, P8S-KK/3	Seminar	Direct observation, Publication
K2	He knows the basic research tools, computer programs and laboratory methods (accelerators) allowing to study the properties of elementary particles.	P8S-WG/3, P8S-WK/3	Seminar	Direct observation, Publication
Skills (no.)	**(Able to)**			
S1	Can use basic techniques computing and computer programs related to the methodology of elementary	P8S-UW/1	Seminar	Direct observation, Publication

	particle research.			
S2	Can critically analyze the obtained research results and evaluate their usefulness in planning further research activities.	P8S-UW/2, P8S-KK/1	Seminar	Direct observation, Publication
S3	He can explain the purposefulness of conducted research and assess the chance of successful completion of the research.	P8S-UK/3, P8S-UK/4, P8S-KK/2	Seminar	Direct observation, Publication
S4	He can initiate cooperation with foreign scientists clearly defining his role in joint research.	P8S-UO, P8S-UU/1	Seminar	Direct observation, Publication
Social competence (no.)	**(Ready to)**			
SC1	Can write a scientific article on a selected field of research.	P8S-WG/4, P8S-WK/3, P8S-UW/3	Seminar	Direct observation, Publication
SC2	It is ready for a public conference or popular science presentation of the obtained research results.	P8S-UW/3, P8S-UK/1, P8S-UK/2	Seminar	Direct observation, Publication
SC3	Can respect the principles of public ownership of the results of scientific activity, taking into account the principles of intellectual property protection.	P8S-KR	Seminar	Direct observation, Publication

LEARNING FORMAT – NUMBER OF HOURS

Semester (no.)	Lectures	Seminars	Lab classes	Internships	others	ECTS
III-IV	0	60	0	0	0	0
V-VI	0	60	0	0	0	0
VII-VIII	0	60	0	0	0	0

METHODS OF INSTRUCTION

Working at a desk with the use of computer equipment, including computer programs for calculations and analysis of the obtained research results; preparing a presentation; discussion.

COURSE CONTENT

2021/2022; sem. III and IV

1. Implementation of theoretical research on processes initiated by single and double photon exchange for the production of leptons and heavy quarks in proton-proton and proton-nucleus collisions for the LHC energies.
2. Analysis and interpretation of the obtained results.
3. Preparation of a scientific paper presenting the obtained results.

4.Theoretical analysis of exclusive (photon initiated) processes for the production of η_c and χ_c mesons in electron-electron collisions.
5. Interpretation of the obtained results and formulation of conclusions.
6. Preparation of a scientific paper presenting the obtained results.

2022/2023; sem. V and VI

1. Description of the selected exclusive and semi-exclusive processes in electron-proton and electron-nucleus collisions at the energies of the new EIC accelerator.
2. Analysis and interpretation of the obtained results.
3. Preparation of a scientific paper presenting the obtained results.

2023/2024; sem. VII and VIII

1. Description of the selected exclusive and semi-exclusive processes with the energies of the new EIC accelerator.
2. Preparation of a scientific paper.
3. Writing a PhD dissertation.

COURSE ASSESSMENT CRITERIA

Due to the individual nature of the course (working with one student), the checking and assessment of learning outcomes is done on an ongoing basis.

TOTAL PhD STUDENT WORKLOAD REQUIRED TO ACHIEVE THE INTENDED LEARNING OUTCOMES – NUMBER OF HOURS AND ECTS CREDITS

Activity	Number of hours
Scheduled course contact hours	180
Other contact hours involving the teacher (consultation hours, examinations)	20
Non-contact hours – student`s own work (preparation for classes or examinations, project, etc.)	230
Total number of hours	430

Total number of ECTS credits	0
INSTRUCTIONAL MATERIALS	
Compulsory literature:	1. D. H. Perkins: "Wstęp do Fizyki Wysokich Energii", PWN 2004. 2. J. Bartke: "Introduction to Relativistic Heavy Ion Physics", World Scientific 2009.E. 3. E. Skrzypczak, Z. Szefliński: "Wstęp do fizyki jądra atomowego i cząstek elementarnych", PWN, Warszawa, 2002. 4. E. Leader, G. Predazzi: "Wstęp do teorii oddziaływań kwarków i leptonów", PWN, Warszawa, 1990. 5. F. Halzen, A. D. Martin: "Quarks and Leptons: An introductory course in modern particle physics", New York, 1984. 6. B. H. Bransden, D. Evans, J.V. Major: "Cząstki elementarne", PWN, Warszawa, 1981. 7. W von Schlippe: "Relativistic Kinematics of Particle Interactions", 2002.
Complementary literature:	1. W.Florkowski: "Phenomenology of Ultra□Relativistic Heavy-Ion Collisions", World Scientific 2010. 2. F. Close: "Kosmiczna cebula", 1988. 3. V. Barger, R. J. N. Phillips: "Collider physics", 1987.