

**Subject card**

<b>Subject name and code</b>	Master Diploma Lab, PG_00182342						
<b>Field of study</b>	Physics						
<b>Date of commencement of studies</b>	October 2026	<b>Academic year of realisation of subject</b>			2027/2028		
<b>Education level</b>	Master's studies	<b>Subject group</b>			Obligatory subject group in the field of study		
<b>Mode of study</b>	full-time studies	<b>Mode of delivery</b>			at the university		
<b>Year of study</b>	2	<b>Language of instruction</b>			Polish		
<b>Semester of study</b>	3	<b>ECTS credits</b>			10.0		
<b>Learning profile</b>	academic	<b>Assessment form</b>			credit		
<b>Conducting unit</b>	Faculty of Mathematics, Physics and Informatics -> Rector						
<b>Name and surname of lecturer (lecturers)</b>	<b>Subject supervisor</b>		dr hab. Michał Studziński				
	<b>Teachers</b>						
<b>Lesson types</b>	<b>Lesson type</b>	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	<b>Number of study hours</b>	0.0	0.0	135.0	0.0	0.0	135
	E-learning hours included: 0.0						
<b>Learning activity and number of study hours</b>	<b>Learning activity</b>	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	<b>Number of study hours</b>	135		0.0		115.0	250
<b>Subject objectives</b>	Preparing the student to write a masters thesis and introducing them to the use of research methods, tools, and procedures employed in the development and presentation of scientific results.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[FIZMU2_U02] has the ability to plan and carry out basic and advanced experiments or observations in specific areas of physics or its applications	<p>The student is able to:</p> <ul style="list-style-type: none"> <li>– plan and carry out advanced experiments necessary for completing a master’s thesis,</li> <li>– perform a critical analysis of measurement, observation, and theoretical–computational results, including an assessment of their accuracy,</li> <li>– locate essential information in professional literature, both in databases and other sources,</li> <li>– reconstruct the line of reasoning or the course of an experiment described in the literature, taking into account the underlying assumptions and approximations,</li> <li>– apply methods and ideas from different areas of physics as well as from other natural and exact sciences,</li> <li>– recognize that seemingly “distant” phenomena are often described by similar models,</li> <li>– adapt the knowledge and methodology of physics, including experimental and theoretical techniques, to related scientific disciplines.</li> </ul>	<p>[SU1] oral statement/conversation/discussion  [SU2] presentation/project/paper/report  [SU5] implementation of a problem task</p>
	[FIZMU2_W04] knows the principle of operation of measuring systems and research equipment specific to the area of physics related to the selected specialization or knows advanced methods of theoretical and mathematical physics	<p>The student knows:</p> <ul style="list-style-type: none"> <li>– advanced experimental, observational, and numerical techniques that enable the planning and execution of complex physical experiments or computer simulations necessary for completing a master’s thesis,</li> <li>– the operating principles of measurement systems and research apparatus, as well as advanced methods of theoretical and mathematical physics used in carrying out a master’s thesis,</li> <li>– current directions of development in physics within the chosen specialization,</li> <li>– occupational health and safety principles at a level that allows independent work in the area of the chosen specialization,</li> <li>– the basic legal and ethical requirements related to scientific activity,</li> <li>– the fundamental concepts and principles of industrial property protection and copyright law,</li> <li>– the rules for using patent-information resources.</li> </ul>	<p>[SW1] oral statement/conversation/discussion  [SW2] presentation/project/paper/report  [SW5] implementation of a problem task</p>

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	<p>[FIZMU2_W03] knows experimental, observational and numerical techniques to plan and perform a complex physics experiment or computer simulation</p>	<p>The student knows:</p> <ul style="list-style-type: none"> <li>– advanced experimental, observational, and numerical techniques that enable the planning and execution of complex physical experiments or computer simulations required for completing a master's thesis,</li> <li>– the operating principles of measurement systems and research apparatus, as well as advanced theoretical and mathematical physics methods used in the preparation of a master's thesis,</li> <li>– current trends in the development of physics within the chosen specialization,</li> <li>– health and safety regulations at a level that allows independent work in the area of the chosen specialization,</li> <li>– the basic legal and ethical requirements related to scientific activity,</li> <li>– the fundamental concepts and principles of industrial property protection and copyright law,</li> <li>– the rules for using patent-information resources.</li> </ul>	<p>[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW5] implementation of a problem task</p>
	<p>[FIZMU2_W08] knows and understands the legal and ethical conditions related to scientific and didactic activities</p>	<p>The student knows:</p> <ul style="list-style-type: none"> <li>– advanced experimental, observational, and numerical techniques that make it possible to plan and carry out a complex physical experiment or computer simulation necessary for completing a master's thesis,</li> <li>– the operating principles of measurement systems and research apparatus, as well as advanced methods of theoretical and mathematical physics used in the preparation of a master's thesis,</li> <li>– current directions of development in physics within the chosen specialization,</li> <li>– health and safety regulations at a level that enables independent work in the area of the chosen specialization,</li> <li>– the basic legal and ethical requirements related to scientific research,</li> <li>– fundamental concepts and principles of industrial property protection and copyright law,</li> <li>– the rules for using patent-information resources.</li> </ul>	<p>[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW5] implementation of a problem task</p>

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	<p>[FIZMU2_U03] is able to make a critical analysis of the results of measurements, observations or theoretical calculations along with the assessment of the accuracy of the results</p>	<p>The student is able to:</p> <ul style="list-style-type: none"> <li>– plan and conduct advanced experiments necessary for the completion of a master’s thesis,</li> <li>– perform critical analysis of measurement, observational, and theoretical–computational results, including an assessment of their accuracy,</li> <li>– locate essential information in professional literature, both in databases and in other sources,</li> <li>– reconstruct the reasoning or the course of an experiment described in the literature, taking into account the stated assumptions and approximations,</li> <li>– apply methods and concepts from various areas of physics as well as from other exact and natural sciences,</li> <li>– recognize that seemingly “distant” phenomena are often described by similar models,</li> <li>– adapt the knowledge and methodology of physics— including experimental and theoretical techniques—to related scientific disciplines.</li> </ul>	<p>[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU5] implementation of a problem task</p>
	<p>[FIZMU2_U04] can find the necessary information in professional literature, both in databases and in other sources; can reconstruct the reasoning or the course of an experiment described in the literature, taking into account the assumptions and approximations made</p>	<p>The student is able to:</p> <ul style="list-style-type: none"> <li>– plan and carry out advanced experiments required for the completion of a master’s thesis,</li> <li>– perform a critical analysis of measurement, observational, and theoretical–computational results, including an assessment of their accuracy,</li> <li>– locate essential information in professional literature, both in databases and in other sources,</li> <li>– reconstruct the reasoning or the course of an experiment described in the literature, taking into account the stated assumptions and approximations,</li> <li>– apply methods and concepts from various areas of physics as well as from other exact and natural sciences,</li> <li>– recognize that seemingly “distant” phenomena are often described by similar models,</li> <li>– adapt the knowledge and methodology of physics— including experimental and theoretical techniques—to related scientific disciplines.</li> </ul>	<p>[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU5] implementation of a problem task</p>

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	<p>[FIZMU2_K03] is aware of the responsibility for jointly performed tasks</p>	<p>The student understands / is aware of / is able to:</p> <ul style="list-style-type: none"> <li>– formulate questions precisely,</li> <li>– recognize the need for continuing their own education and supporting the education of others,</li> <li>– apply the scientific method in the acquisition of knowledge,</li> <li>– work both independently and as part of a team,</li> <li>– acknowledge responsibility for tasks carried out within a team,</li> <li>– understand the importance of intellectual honesty in their own work and in the work of others,</li> <li>– identify ethical issues in the context of research integrity,</li> <li>– formulate well-reasoned opinions on professional matters and on selected issues of public interest,</li> <li>– think and act in an entrepreneurial manner,</li> <li>– popularize knowledge in the field of physics,</li> <li>– assess the risks involved in obtaining information from unverified sources, including the Internet.</li> </ul>	<p>[SK1] oral statement/conversation/discussion  [SK2] presentation/project/paper/report  [SK5] implementation of a problem task</p>
	<p>[FIZMU2_U11] is able to determine the directions of further improvement of knowledge and skills (including self-education) in the field of the selected specialization and beyond it</p>	<p>The student is able to:</p> <ul style="list-style-type: none"> <li>– plan and conduct advanced experiments required for the completion of a master's thesis,</li> <li>– perform critical analysis of measurement, observational, and theoretical–computational results, including an assessment of their accuracy,</li> <li>– locate essential information in professional literature, both in databases and in other sources,</li> <li>– reconstruct the reasoning or the course of an experiment described in the literature, taking into account the stated assumptions and approximations,</li> <li>– apply methods and concepts from various areas of physics as well as from other exact and natural sciences,</li> <li>– recognize that seemingly “distant” phenomena are often described by similar models,</li> <li>– adapt the knowledge and methodology of physics— including experimental and theoretical techniques—to related scientific disciplines.</li> </ul>	<p>[SU1] oral statement/conversation/discussion  [SU2] presentation/project/paper/report  [SU5] implementation of a problem task</p>

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	<p>[FIZMU2_K07] is aware of the responsibility for jointly (team) research tasks</p>	<p>The student is able to / is aware of:</p> <ul style="list-style-type: none"> <li>– continuing their own education and supporting the education of others,</li> <li>– applying the scientific method to the acquisition of knowledge,</li> <li>– working both independently and as part of a team,</li> <li>– recognizing their responsibility for tasks carried out within a team,</li> <li>– understanding the importance of intellectual honesty in their own work and in the work of others,</li> <li>– identifying ethical issues in the context of research integrity,</li> <li>– formulating competent opinions on professional matters and on selected issues of public interest,</li> <li>– thinking and acting in an entrepreneurial manner,</li> <li>– popularizing knowledge in the field of physics,</li> <li>– assessing the risks of obtaining information from unverified sources, including the Internet.</li> </ul>	<p>[SK1] oral statement/conversation/discussion  [SK2] presentation/project/paper/report  [SK5] implementation of a problem task</p>
	<p>[FIZMU2_W07] knows the principles of occupational health and safety to the extent that allows for independent work in the area corresponding to the discipline</p>	<p>The student knows:</p> <ul style="list-style-type: none"> <li>– advanced experimental, observational, and numerical techniques that make it possible to plan and carry out a complex physical experiment or computer simulation necessary for completing a master's thesis,</li> <li>– the operating principles of measurement systems and research apparatus, as well as advanced methods of theoretical and mathematical physics used in the execution of a master's thesis,</li> <li>– current trends in the development of physics within the chosen specialization,</li> <li>– health and safety regulations at a level enabling independent work in the area of the chosen specialization,</li> <li>– the basic legal and ethical requirements associated with scientific research,</li> <li>– fundamental concepts and principles of industrial property protection and copyright law,</li> <li>– the rules for using patent-information resources.</li> </ul>	<p>[SW1] oral statement/conversation/discussion  [SW2] presentation/project/paper/report  [SW5] implementation of a problem task</p>
	<p>[FIZMU2_U08] can effectively communicate with both specialists and non-specialists in the area of study related to physics and to organize and lead discussions and debates on the subject</p>	<p>The student is able to:</p> <ul style="list-style-type: none"> <li>– plan and carry out advanced experiments required for the completion of a master's thesis,</li> <li>– perform critical analysis of measurement, observation, and theoretical-computational results, including an assessment of their accuracy,</li> <li>– locate essential information in professional literature, both in databases and in other sources,</li> <li>– reconstruct the reasoning or the course of an experiment described in the literature, taking into account the stated assumptions and approximations,</li> <li>– apply methods and concepts from various areas of physics as well as from other exact and natural sciences,</li> <li>– recognize that seemingly "distant" phenomena are often described by similar models,</li> <li>– adapt the knowledge and methodology of physics, including experimental and theoretical techniques, to related scientific disciplines.</li> </ul>	<p>[SU1] oral statement/conversation/discussion  [SU2] presentation/project/paper/report  [SU5] implementation of a problem task</p>

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Subject contents	<p><b>Depending on the nature of the masters thesis (experimental or theoretical), the student:</b> gains in-depth knowledge of the current state of research in the field of the masters thesis, becomes familiar with the conditions, organization, and health and safety regulations of a laboratory equipped with advanced scientific research apparatus and/or computers, becomes acquainted with advanced instruments, measurement equipment, and scientific software, prepares and calibrates measurement apparatus and/or develops numerical codes necessary for carrying out the masters thesis, performs measurements and/or numerical calculations, processes and analyses measurement results, prepares the masters thesis.</p>										
Prerequisites and co-requisites	<p><b>A. Formal requirements:</b> Completion of courses thematically related to the masters thesis at the undergraduate (bachelors) level.</p> <p><b>B. Prerequisites:</b> Knowledge of selected areas of physicsmechanics, thermodynamics, atomic and molecular physics, electricity and magnetism, optics, nuclear physics, condensed matter physics, quantum physics, and mathematical physicsat the undergraduate level.</p>										
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>not applicable</td> <td>51.0%</td> <td>40.0%</td> </tr> <tr> <td>not applicable</td> <td>51.0%</td> <td>60.0%</td> </tr> </tbody> </table>		Subject passing criteria	Passing threshold	Percentage of the final grade	not applicable	51.0%	40.0%	not applicable	51.0%	60.0%
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<p>Example issues/ example questions/ tasks being completed</p>	<ul style="list-style-type: none"> <li>-Review of the current state of research in a selected field of physics (e.g., quantum information, condensed matter, quantum optics).</li> <li>-Advanced measurement methods and research apparatus related to the topic of the masters thesis.</li> <li>-Which factors limit the accuracy of measurements in your experiment, and how can they be minimized?</li> <li>-What are the main assumptions adopted in your theoretical model, and what consequences might they have?</li> <li>-Calibration of a spectrometer/optical setup and verification of the proper functioning of the apparatus.</li> <li>-Implementation of a computational model described in the literature and comparison of the results with experimental data.</li> <li>-Preparation of a seminar presenting the progress of the research work.</li> <li>-Development of the review chapter of the masters thesis based on the literature.</li> </ul>
<p>Work placement</p>	<p>Not applicable</p>

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