

## FORMAL REQUIREMENTS AND ADMINISTRATION OF DOCTORAL STUDIES

Version: Released and applicable since 1st August 2019 (last update: May 2025)

PhD programme: **Physics**

Guarantor/Doctoral Board head contact: **Rikard von Unge**

General requirements for all students in the programme (please see detailed requirements for the Individual Study Plan in the detailed table below).

Mandatory courses: *checked by Dean's Office*

<b>XD100</b>	<b>Ph.D. thesis / Příprava dizertační práce</b>	<i>each semester (25 ECTS for semesters 1-4, 30 ECTS for semesters 5-8, 20 ECTS for semesters 9+)</i>
<b>F6710, 6720 or F6730</b>	<b>Programme seminar</b>	<i>enrol course in accordance to affiliation to Physics institute of the supervisor, obligatory for the standard duration of studies (with exception for the Plasma Physics specialization, where it is required for 6 semesters) except for stays abroad, other seminars as needed</i>
<b>XD106</b>	<b>Lecture in the foreign language / Odborná přednáška v cizím jazyce</b>	<i>Minimum one-time (zero ECTS)</i>
	<b>Placement Abroad / Zahraniční pracovní pobyt</b>	<i>Minimum 1 month stay, min. once during studies (usually 5 ECTS/month), requirement given by law</i> Instructions for recognition of Placement Abroad: <a href="https://www.sci.muni.cz/en/students/go-abroad/recognition-of-stay-abroad">https://www.sci.muni.cz/en/students/go-abroad/recognition-of-stay-abroad</a> (the recognition is done via IS application Internship and Stays, by creating record of the stay and request for recognition; the course is then registered by Dean's Office)
<b>XD102</b>	<b>Teaching Assistance / Pomoc při výuce</b>	<i>maximum 150 hours total during studies</i>

Theoretical courses and all other requirements: *checked by the Head of Doctoral Board / Head of Doctoral Committee*

- Theoretical courses – depending on the field of study, see below table.

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*(\*) Requirements for theoretical SDE:*

Elements of the ISP		Milestones and their check by the end of				
		Semester 0	Semester 2	Semester 4	Semester 6	Semester 8 (Preparation for PhD defence)
(A) research and development activities (ca. 70 % of workload)	<b>1. Research, dissertation project</b> , literature search of the actual state of the topic, planning and the scientific activities itself (50 %).	Define dissertation topic with potential supervisor. <b>CHECK: Doctoral Board -&gt; Dean's office [enrolment]</b>			Oral presentation in English at the appropriate institute seminar	Submit PhD thesis according to the instructions of the Doctoral Board. Format according to SCI MUNI requirements  <b>CHECK: Doctoral Board, Dean's office</b>
	<b>2. Publications</b> The thesis should be based on at least one paper demonstrating quality and independence of the student (15 %)					At least one publication in a refereed international scientific journal <b>CHECK: Doctoral Board [during thesis defense]</b>
	<b>3. Presentation</b> of results on scientific seminars, symposia, conferences etc., including preparation of talks and/or poster presentations (5 %)				Oral presentation in English at the appropriate institute seminar	At least one presentation in English at an international scientific conference <b>CHECK: Dean's office</b>
(B) Specialized courses and theoretical	<b>4. Theoretical courses</b> , preparation to the state doctoral exam – SDE (25 %)	Identify knowledge gaps and what should be learned for the SDE. Plan		Submit <b>the application to theoretical SDE</b> (Doctoral Board		

preparation (ca. 30 %)		courses to accordingly. Consider courses at MU or outside. Selection can be changed/updated for each semester.		and its subcommittees organize SDE further). <b>CHECK: Doctoral Board</b>		
	5. <b>Doctoral seminars</b> (5 %)	according to affiliation to physics institute, others as needed <b>CHECK: Dean's office</b>				
(C) International experience and competitiveness	6. <b>Further improving of English competences</b> (attending courses, seminars, conferences, writing publications, all in English).				Oral presentation in English at the appropriate institute seminar	At least one presentation in English at an international scientific conference <b>CHECK: Dean's office</b>
	7. <b>Stay or internship abroad</b> - mandatory participation in international cooperation.					Placement abroad of a least one month in total duration <b>CHECK: Dean's office [stay abroad in IS; e.g. XD110]</b>
(D) Pedagogical competences	8. <b>Teaching assistance</b> - classrooms, exercises, advising undergrad students and comparable.					Maximum 150 classroom hours or equivalent

(E) Other transferrable skills.	<b>9. Career development</b> - preparation and management of projects, scientific writing, communication, other soft-skills.	No formal check needed			
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### Required and Elective theoretical courses and seminars

#### Astrophysics

Required:

PřF:F6730 Seminar of Institute of Theoretical Physics and Astrophysics

Elective:

PřF:FA025 The Standard Model of Cosmology

PřF:FA035 Advanced methods in data analysis

PřF:FA045 Selected chapters from modern computational methods

PřF:FA050 Scientific projects, PřF:FA055 The structure and evolution of stars

PřF:FA221 Open problems of physics of stellar atmospheres and winds,

PřF:FA222 Star Clusters, PřF:FB040 Advanced Hydrodynamics

#### Biophysics

Required:

PřF:F7790 Seminar in Biophysics and Biophysical Chemistry

Elective:

PřF:FB810 Problems and Issues of Molecular Modeling

PřF:FB820 Structural electron microscopy

PřF:FB830 Methods of Structural Biology

PřF:FB840 Integrative Structural Biology

PřF:FB850 Interactions between biomolecules

PřF:FB860 Concepts in Biophysics

### **Condensed Matter Physics**

Required:

PřF:F6720 Seminar of Institute of Condensed Matter Physics

PřF:FK010 Structural analysis methods in condensed matter physics

PřF:FK020 Electrodynamics of Solids

Elective:

PřF:FA015 Statistical Physics of Particles and Fields

PřF:FB035 Selected Chapters in Modern Optics

PřF:FC210 Advanced Quantum Field Theory

PřF:FK110 Diagrammatic methods in modern condensed matter physics

PřF:FK120 Physics of strongly correlated electron systems

PřF:FK130 Monte Carlo simulation as a numerical tool

### **General Physics**

Required:

PřF:F6730 Seminar of Institute of Theoretical Physics and Astrophysics

Elective:

PřF:F3089 Secondary school physics revisited 1

PřF:F3400 Elementary concepts and principles of classical mechanics 1

PřF:F4400 Elementary concepts and principles of classical mechanics 2

PřF:F9051 Elements of physical theories 1

PřF:FA052 Elements of physical theories 2

PřF:FB122 Seminar on Mathematical Physics

PřF:FB210 Mathematical foundations of the variational theories in physics

PřF:FB225 Geometry and topology

### **Plasma physics**

Required:

PřF:F6710 Seminar of Department of Physical Electronics

PřF:FC154 Individual study 1

PřF:FB153 Individual study 2

Selective:

PřF:FB501 Plasma Diagnostics and Simulations

PřF:FB502 Deposition and analysis of thin films

PřF:FB503 Surface modifications and plasma applications

Elective:

PřF:F7900 Students seminary

PřF:FB010 Elementary processes in plasma 2

PřF:FB041 Seminar on plasma deposition and material characterization

PřF:FB100 Plasma chemical processes

PřF:FB240 Plasma physics 3

PřF:FC020 Numerical methods in plasma physics

PřF:FC250 Plasma and Dry Nano/Microtechnologies

PřF:FC500 Analytical models and advanced concepts in plasma physics

PřF:FC510 Special topics in nanotechnology science

### **Theoretical Physics**

Required:

PřF:F6730 Seminar of Institute of Theoretical Physics and Astrophysics

PřF:FA015 Statistical Physics of Particles and Fields

PřF:FC210 Advanced Quantum Field Theory

Elective:

PřF:FA020 The Standard Model of Particle Physics

PřF:FA025 The Standard Model of Cosmology

PřF:FA040 Advanced mathematical methods in theoretical physics

PřF:FB035 Selected Chapters in Modern Optics

PřF:FK020 Electrodynamics of Solids

PřF:FK110 Diagrammatic methods in modern condensed matter physics

PřF:FK120 Physics of strongly correlated electron systems

PřF:FK130 Monte Carlo simulation as a numerical tool

### **Wave and Particle Optics**

Required:

PřF:F6730 Seminar of Institute of Theoretical Physics and Astrophysics

PřF:F7511 Optics of charged particles – theory

PřF:F9190 Modern laser applications

Elective:

PřF:FK020 Electrodynamics of Solids

PřF:FK130 Monte Carlo simulation as a numerical tool