Graduate Major in Physics

[Master's Degree Program]

1. Outline

The physics course aims to explore the fundamental laws and principles underlying physical phenomena and understand elementary particles, nuclei to universe in unified framework, and also to explore new substances and investigate the structural and physical properties of substances. This program aims to foster the flexible and creative human resources with the sound knowledge of physics, as researchers, teachers and engineers.

A systematic curriculum is provided in order that students can learn the general knowledge of physics and can make research of specialized fields through seminars and experiments under the instruction of their supervisors. An opportunity for research and education in partnership with other universities and research institutes is also provided. This program is composed of "class subjects" to learn systematically the advanced knowledge and technique for physics and skills of international communication and leadership, and "supervision" to be grounded researchers.

2. Competencies Developed

- Academic competency required for multifaceted understanding to physical phenomena.
- Practical competency to solve problems based on grounded knowledge of physics.
- Competency to explore the fundamental laws and principles underlying physical phenomena.
- Language competency and competency to discuss required for international research activities.
- Competency to conduct creative research with ethical perspective.

3. Learning Goals

The goals of the active learning provided in the course to obtain the competencies described in the curriculum are as follows:

- A) Mastery of deep understanding in physics and high-standard specialized knowledge through seminars and ones own study for the doctor thesis
- B) Mastery of skills to creatively establish and solve problems through the thesis study and small-group education in each state-of-the-art science laboratory
- C) Mastery of cutting-edge knowledge in intensive courses
- D) Mastery of practical skills for foreign language, academic presentations, and scientific communications through pragmatical classes, colloquiums, and overseas visits
- E) Mastery of the leadership through the planning and arrangement of international research meetings

4. IGP Completion Requirements

The following requirements must be met to complete the Master's Degree Program of this major.

- 1. A total of 30 credits or more acquired from 400- and 500-level courses.
- 2. Meet the completion requirements from the courses specified in the Graduate Major in Physics curriculum (see Table M1 below).
 - 4 credits acquired from Research Seminars.

• 2 credits for Colloquium in Physics I and II, and 8 credits or more from Exercises in Physics Course or Laboratory Work in Physics Course acquired from Research Related Courses.

• A minimum of 23 credits acquired from major courses, including Research Seminars and Research Related Courses.

• A minimum of 5 credits acquired from Liberal Arts and Basic Science Courses, including 2 credits or more from the 400-level and one credit or more from 500-level Humanities and Social Science Courses, and 2 credits or more from Career Development Courses.

3. Pass the master's thesis review and defense.

Course category		<required courses=""> Required credits</required>	<electives> Minimum credits required</electives>	Minimum credits required	Associated learning goals	Comments
Liberal arts	Humanities and social science courses		 2 credits from 400-level 1 credit from 500-level			
and basic science courses	Career development courses		2 credits	5 credits	D, E	
	Other courses					
	Research seminars	Research Seminar in Physics S1 Research Seminar in Physics F1 Research Seminar in Physics S2 Research Seminar in Physics F2 A total of 4 credits, 1 credit each from the above courses.			Α, Β	
Core courses	Research-rel ated courses	Colloquium in Physics I Colloquium in Physics II A total of 2 credits, 1 credit each from the above courses.	Exercises in Physics Course Laboratory Work in Physics Course A total of 8 credits from the above courses.	23 credits	C, D, E	
Core courses	Major courses			•	A, C, D, E	
	Major courses and Research-rel ated courses <u>outside</u> the Graduate Major in Physics standard curriculum					
Total required	credits	A minimum of 30 credits in add				
Note		• Japanese Language and Cult Humanities and Social Science Co			ents can be r	ecognized as

Table M1. Graduate Major in Physics Completion Requirements

• As for Liberal Arts and Basic Science Courses and Career Development Courses, please refer to the
relevant pages.

5. IGP Courses

Table M2. Core Courses of the Graduate Major in Physics

Cou	rse	Course	Co	ourse		Credits	Compet	Learning	Comments
categ	gory	number					encies	goals	
Re	400	PHY.Z491.R	0		Seminar in Physics S1	0-1-0	1,2,3	A, B	
Research seminars	level	PHY.Z492.R	0		Seminar in Physics F1	0-1-0	1,2,3	А, В	
minars	500	PHY.Z591.R	0		Seminar in Physics S2	0-1-0	1,2,3	A, B	
	level	PHY.Z592.R	0		Seminar in Physics F2	0-1-0	1,2,3	A, B	
		PHY.P403.B	0		Exercises in Physics Course S1	0-2-0	1,2,3,4,5	А, В	
Resear		PHY.P404.B	0		Laboratory Work in Physics Course S1	0-0-2	1,2,3,4,5	А, В	
Research-related courses		PHY.P405.B	0		Exercises in Physics Course F1	0-2-0	1,2,3,4,5	A, B	
d courses		PHY.P406.B	0		Laboratory Work in Physics Course F1	0-0-2	1,2,3,4,5	A, B	
	400	PHY.P413.L		*	Practical Exercises in International Research I	0-1-0	1,2,3	D	
	level	PHY.P414.L		*	Practical Exercises in International Research II	0-1-0	1,2,3	D	
		PHY.P415.L		*	Practical Exercises in Organizing International Conferences I	0-1-0	1,2,3	D, E	
		PHY.P416.L		*	Practical Exercises in Organizing International Conferences II	0-1-0	1,2,3	D, E	
		PHY.P417.R	0		Colloquium in Physics I	0-1-0	2,3,4	D	
		PHY.P418.R	0		Colloquium in Physics II	0-1-0	2,3,4	D	
		РНҮ.Р503.В	0		Exercises in Physics Course S2	0-2-0	1,2,3,4,5	A, B	
	500	PHY.P504.B	0		Laboratory Work in Physics Course S2	0-0-2	1,2,3,4,5	А, В	
	level	РНҮ.Р505.В	0		Exercises in Physics Course F2	0-2-0	1,2,3,4,5	A, B	
		PHY.P506.B	0		Laboratory Work in Physics Course F2	0-0-2	1,2,3,4,5	A, B	

	PHY.C439.L		Physics of Magnetic Materials	1-0-0	3,5	A	
	PHY.C441.L		Crystal Physics	2-0-0	3,5	A	
	PHY.C442.L		Superfluidity	1-0-0	3,5	А,	
	PHY.C443.L		Superconductivity	1-0-0	3,4,5	A	
	PHY.C444.L		Quantum Transport	1-0-0	3,5	A	
	PHY.C445.L		Surface Physics	1-0-0	3,5	A	
	PHY.C446.L		Light and Matter I	1-0-0	3,4,5	А	
	PHY.C447.L		Light and Matter II	1-0-0	3	А	
	PHY.C448.L		Light and Matter III	1-0-0	3	А	
	PHY.C449.L		Laser Physics	1-0-0	3	А	
400	PHY.C450.L		Quantum Theory of Electrons in Solids	2-0-0	3,4,5	А,	
level	PHY.C451.L		Physics of Soft Matter	1-0-0	3,5	А	
	PHY.F430.L		Hadron Physics	2-0-0	3,5	А	
	PHY.F431.L		Cosmology	1-0-0	3	А	
	PHY.F432.L		Astrophysics	1-0-0	3	A	
	PHY.F436.L		Advanced Particle Physics	2-0-0	1,3	А	
	PHY.F437.L		Advanced Nuclear Physics	2-0-0	3,4,5	А	
	PHY.L412.L		Fundamental Physics Experiments	0-0-1	1,2,3,4,5	А	
	PHY.P410.L	*	Basic Writing in Physics	2-0-0	2,3,4	D	
	PHY.P411.L	*	Basic Presentation in Physics	2-0-0	1,2	D	
	PHY.Q433.L		Field Theory I	2-0-0	3,5	А	
	PHY.Q434.L		Field Theory II	2-0-0	3	А	
		PHY.C441.L PHY.C441.L PHY.C442.L PHY.C443.L PHY.C443.L PHY.C444.L PHY.C445.L PHY.C446.L PHY.C446.L PHY.C447.L PHY.C449.L PHY.C449.L PHY.C450.L PHY.C450.L PHY.C450.L PHY.C450.L PHY.C451.L PHY.F430.L PHY.F430.L PHY.F431.L PHY.F431.L PHY.F431.L PHY.F432.L PHY.F432.L PHY.F431.L PHY.F432.L PHY.F433.L PHY.F433.L PHY.F433.L PHY.F433.L PHY.F433.L PHY.F433.L PHY.F433.L PHY.P411.L PHY.P411.L PHY.Q433.L PHY.Q433.L	PHY.C441.L I PHY.C442.L I PHY.C443.L I PHY.C443.L I PHY.C443.L I PHY.C443.L I PHY.C443.L I PHY.C443.L I PHY.C445.L I PHY.C445.L I PHY.C445.L I PHY.C443.L I PHY.C443.L I PHY.C449.L I PHY.C450.L I PHY.C450.L I PHY.F430.L I PHY.F430.L I PHY.F431.L I PHY.F433.L I PHY.F437.L I PHY.F437.L I PHY.PHY.P410.L I PHY.P410.L I PHY.Q433.L I	PHY.C441.L Crystal Physics PHY.C441.L Superfluidity PHY.C442.L Superconductivity PHY.C443.L Quantum Transport PHY.C443.L Quantum Transport PHY.C444.L Quantum Transport PHY.C445.L Surface Physics PHY.C446.L Light and Matter I PHY.C446.L Light and Matter II PHY.C447.L Light and Matter III PHY.C449.L Light and Matter III PHY.C449.L Laser Physics PHY.C450.L Quantum Theory of Electrons in Solids PHY.C451.L Physics of Soft Matter PHY.F430.L Hadron Physics PHY.F431.L Cosmology PHY.F431.L Advanced Particle Physics PHY.F431.L Advanced Nuclear Physics PHY.F437.L Advanced Nuclear Physics PHY.F437.L Fundamental Physics Experiments PHY.PH10.L * Basic Writing in Physics PHY.P411.L Field Theory I	Image: Section of the sectio	Image: Angle	Image: Section of the sectio

	PHY.Q435.L		Quantum Information	2-0-0	3,4	А	
	PHY.Q438.L		Quantum Mechanics of Many-Body Systems	2-0-0	3,5	A	
	PHY.S440.L		Statistical Mechanics III	2-0-0	3	С	
	PHY.P530.L		Special Lectures in Physics I	1-0-0	3,5	C	
	PHY.P531.L		Special Lectures in Physics II	1-0-0	3,5	C	
	PHY.P532.L	*	Special Lectures in Physics III	1-0-0	3,5	C	
	PHY.P533.L		Special Lectures in Physics IV	1-0-0	3,5	С	
-	PHY.P534.L		Special Lectures in Physics V	1-0-0	3,5	C	
500 level	PHY.P535.L		Special Lectures in Physics VI	1-0-0	3,5	C	
	PHY.P550.L		Special Topics in Physics I	1-0-0	3,5	C	
	PHY.P551.L		Special Topics in Physics II	1-0-0	3,5	C	
	PHY.P552.L		Special Topics in Physics III	1-0-0	3,5	C	
	PHY.P553.L		Special Topics in Physics IV	1-0-0	3,5	C	

Note :

• \odot : Required course, \bigcirc : Restricted elective, \bigstar : Classes in English

• Competencies: 1 = Intercultural skills; 2 = Communication skills; 3 = Specialist skills; 4 = Critical thinking skills;

5 = Practical and/or problem-solving skills

• The character preceding the three digits in the course number denotes the course's subdiscipline (i.e., "D" represents the subdiscipline code in the course number ABC.D400.R): C: Condensed matter physics, E: Electromagnetism, F: Fundamental physics, G: General, L: Laboratory, M: Mathematical physics, P: Common, Q: Quantum mechanics, S: Statistical mechanics, Z: Research Seminars

6. IGP Courses That Can be Recognized as Humanities and Social Science Courses

None

7. IGP Courses That Can be Recognized as Career Development Courses

As a general rule, students who would like their Career Development Courses to contribute to completion requirements of their master's degree program need to satisfy all of the specified Graduate Attributes ("GA"), including the attainment of at least two course credits, listed in Table MA-1 of the "Guide to Graduate Education and International Graduate Program (Liberal Arts and Basic Science Courses) - Career Development Courses". The status of the GA will be evaluated at the time of degree completion.

In addition to Career Development Courses, there are Major Courses that can also be recognized as such — shown below in Table M3 — which may go toward fulfilling the GA requirements.

However, note that when the corresponding Major Courses are recognized and accredited as Career Development Courses, their credits cannot be counted a second time (as Major Courses) towards degree completion requirements.

Course category	Course number	Co	ourse		Credits	GA*	Learning goals	Comments
	XIP.A401		*	Special International Practice in Science	0-2-0	СІМ		Common Course of School of Science <u>Outside</u> the Graduate Major in Physics standard curriculum
can be recognized	PHY.P413.L		*	Practical Exercises in International Research I	0-1-0	C1M	D	
as Career Developmen	PHY.P414.L		*	Practical Exercises in International Research II	0-1-0	C1M	D	
t Courses	PHY.P415.L		*	Practical Exercises in Organizing International Conferences I	0-1-0	C1M	D, E	
	PHY.P416.L		*	Practical Exercises in Organizing International Conferences II	0-1-0	C1M	D, E	
	PHY.P410.L		*	Basic Writing in Physics	2-0-0	СОМ	D	
	PHY.P411.L		*	Basic Presentation in Physics	2-0-0	СОМ	D	

Table M3. Courses of the Graduate Major in Physics that can be recognized as Career Development Courses

 \star : Classes in English

To satisfy the Career Development Courses requirement, credits may be acquired from courses listed above as well as from those listed under Career Development Courses (see the Liberal Arts and Basic Science Courses Guide).

*****GA: Graduate Attribute

8. Overview of Curriculum System

	[Master course]		Quired course Elective course	Restricted elective	
	1①	12	13	1④	
		Master the	esis research		
	Basic Writing in Physics, PHY.P41	0.L	Basic Presentation in Physics, PH	Y.P411.L	
or courses neral)	Fundamental Physics Experiments, PHY.L412.L	Field Theory I, PHY.Q433.L	Field Theory II, PHY.Q434.L	Quantum Information, PHY.Q435.L	
	Quantum Mechanics of Many- Body Systems, PHY.Q438.L		Statistical Mechanics III, PHY.S440.L		
or courses		Cosmology, PHY.F431.L			
damental	Hadron Physics, PHY.F430.L	Advanced Particle Physics, PHY.F436.L	Astrophysics, PHY.F432.L	3	
sics)	***************	Advanced Nuclear Physics, PHY.F437.L			
	Superfluidity, PHY.C442.L	Superconductivity, PHY.C443.L	Quantum Transport, PHY.C444.L	Crystal Physics, PHY.C441.L	
	superiorder, rinkertere	Superconducting, Fin.e45.c		Surface Physics, PHY.C445.L	
or courses	Light and Matter I, PHY.C446.L	Light and Matter II, PHY.C447.L	Light and Matter III, PHY.C448.L	Laser Physics, PHY.C449.L	
ter physics)		Physics of Magnetic Materials, PHY.C439.L	Quantum Theory of Electrons in Solids, PHY.C450.L	Physics of Soft Matter, PHY.C451.L	
	Colloquium in Physics I, PHY.P417.R]		Colloquium in Physics II, PHY.P418.R	
earch	Practical Exercises in Internationa	al Research I, PHY.P413.L / II, PHY.P4	14.L		
ted courses	Practical Exercises in Organizing I	nternational Conferences I, PHY.P415	5.L / II, PHY.P416.L		
	Exercises in Physics Course S1, Ph Laboratory Work in Physics Course		Exercises in Physics Course F1, Ph Laboratory Work in Physics Cours		
earch inars	Seminar in Physics S1, PHY.Z491.	R	Seminar in Physics F1, PHY.Z492.	R	
or courses	Special Lectures in Physics I, PHY.	P530.L / II, PHY.P531.L / III, PHY.P5	32.L / IV, PHY.P533.L		
ners)	Special Topics in Physics I, PHY.P.	550.L / II, PHY.P551.L / III, PHY.P55	2.L / IV, PHY.P553.L		
	2①	22	23	24	

r courses eral)		Master t	hesis research						
	Practical Exercises in International Researc	:h I PHY.P413.L /II, PHY.P4	114.L						
h	Practical Exercises in Organizing International Conferences I, PHY.P415.L /II, PHY.P416.L								
courses	Exercises in Physics Course S2, PHY.P503.8 Laboratory Work in Physics Course S2, PHY		Exercises in Physics Cour Laboratory Work in Phys	se 2, PHY.P505.8 cs Course F2, PHY.P506.8					
s	Seminar in Physics S2, PHY.Z591.R		Seminar in Physics F2, Ph	(Y.Z592.R					
Special Lectures in Physics I, PHY.P530.L / II, PHY.P531.L / III, PHY.P532.L / IV, PHY.P533.L									
arses	Special Topics in Physics I, PHY.P550.L / I	I, PHY.P551.L / III, PHY.P5	52.L / IV. PHY.P553.L						

9. Example of a Standard Curriculum 1

	[Master course]		Required course Elective course	e Restricted elective
	1①	12	13	1④
		Master	r thesis research	
Major courses (General)	Quantum Mechanics of Many-		Basic Presentation in Physics, PH Statistical Mechanics III.	IY.P411.L Quantum Information.
Major courses	Body Systems, PHY.Q438.L		PHY.S440.L	PHY.Q435.L
(Fundamental physics)	Hadron Physics, PHY.F430.L	Cosmology, PHY.F431.L	Astrophysics, PHY.F432.L	
Research	Colloquium in Physics I, PHY.P417.R			Colloquium in Physics II, PHY.P418.R
related courses	Exercises in Physics Course S1, Ph Laboratory Work in Physics Course		Exercises in Physics Course F1, P Laboratory Work in Physics Cour	
Research seminars	Seminar in Physics S1, PHY.Z491.	R	Seminar in Physics F1, PHY.Z492	R
	2①	22	23	2④
		Master	r thesis research	
Major courses (General)			Basic Writing in Physics, PHY.P41	0.L
Research related courses	Exercises in Physics Course S2, Ph Laboratory Work in Physics Course		Exercises in Physics Course 2, PH Laboratory Work in Physics Cour	Y.P505.B se F2, PHY.P506.B
Research seminars	Seminar in Physics S2, PHY.Z591.	R	Seminar in Physics F2, PHY.2592	R
Major courses (Others)	Special Lectures in Physics I,PHY.P530.		Special Topics in Physics III, PHY.P552.L	

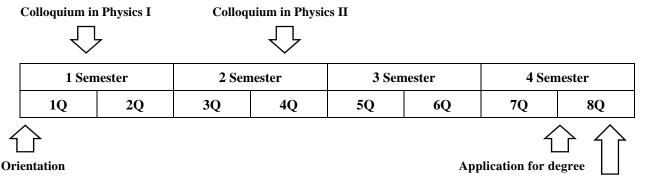
Example of a Standard Curriculum 2

	[Master course]	Req	Lective course	Restricted elective	
	1①	12	13	1@	
		Master the	sis research		
Major courses	Course Markening (Mark	1	Basic Presentation in Physics, PHY	.P411.L	
(General)	Quantum Mechanics of Many- Body Systems, PHY.Q438.L	Field Theory I, PHY.Q433.L	Field Theory II, PHY.Q434.L		
Major courses (Condensed matter physics)	Superfluidity, PHY.C442.L	Superconductivity, PHY.C443.L	Quantum Theory of Electrons in Solids, PHY.C450.L		
Research	Colloquium in Physics I, PHY.P417.R			Colloquium in Physics II, PHY.P418.R	
related courses	Exercises in Physics Course S1, PH Laboratory Work in Physics Course	Y.P403.B ≥ \$1, PHY.P404.B	Exercises in Physics Course F1, PHY.P405.B Laboratory Work in Physics Course F1, PHY.P406.B		
Research seminars	Seminar in Physics S1, PHY.Z491.R		Seminar in Physics F1, PHY.2492.R		
	2①	22	23	2④	
		Master the	esis research		
Major courses (General)			Basic Writing in Physics, PHY.P410.	L	
Research	Practical Exercises in International Research I, PHY.P413.L				
related courses	Exercises in Physics Course S2, PH Laboratory Work in Physics Course		Exercises in Physics Course 2, PHY. Laboratory Work in Physics Course		
Research seminars	Seminar in Physics S2, PHY.Z591.R		Seminar in Physics F2, PHY.Z592.R		
Major courses (Others)	Special Lectures in Physics I,PHY.P530.]	Special Topics in Physics III, PHY.P552.L]	

10. Research Related to the Completion of Master Theses

In the master thesis research, students experience the research process through the small-group specialized instruction in each laboratory promoting cutting-edge research and develop their own skills in problem establishment, problem solving and communication through preparation of theses.

Study Plan



Thesis submission/defense

• The criteria for examination

Following requirements must be met.

- 1. On the research content
 - The content should be the level that contributes the progress in relevant research field.
- 2. On the thesis

It includes an adequate review of the relevant research field. The relative position of the research in the field needs to be clear.

• The thesis review procedure

The review committee consists of at least three faculty members of the physics course. The final judgment is carried out after reviewing the thesis and the presentation by the candidate. The examination for candidate who enters the PhD course is made by at least five faculty members. In this case, a part of presentation is performed in English.

11. Seamless Transition Between Degree Programs

The course program is constructed in order that students can satisfactorily advance their research from the global point of view on the basis of the basic, advanced and cutting-edge knowledge that they learned in the master course. The curriculum includes advanced training courses for research presentation and writing of paper, and courses for the support of overseas research activities and those for training for organizing international conferences.

- Deep understanding in physics acquired by exploring the fundamental laws and principles underlying physical phenomena.
- Competency to penetrate the essence and universality in physical phenomena and that to discover and explore new problems
- Competency to create new knowledge and that to transmit it.
- Competency to lead research frontiers in physics with deep insight and ethical perspective.
- Competency to relate organically physics and other research fields and that to make practical use of the relation.
- Competency to show international leadership in specialized research fields.

As shown in Table D2, the PhD curriculum provides practical major courses of 600-level as those which support domestic and overseas research activities, bearing the internationalization in mind. Advancing major courses of 400- and 500-levels, the PhD curriculum aims to foster researchers who are active in the world.

[Doctoral Degree Program]

1. Outline

This program aims to foster the human resources who can contribute to the progress of the society and the development of natural science. We expect the students to become the leaders in the fundamental natural science field, and to preserve and develop the science with uninhibited ideas and intellectual curiosities.

2. Competencies Developed

The program focuses on the academic development of the following competencies, and sets the higher standard than that in the master course.

- Competency to create and send out new findings based on the broad and systematic knowledge of natural science

- Competency to discover and explore new subjects with deep considerations of the essence and universality

- Competency to lead the forefront of natural science with deep insight and noble ethics

- Competency to organically combine and utilize the knowledge of natural science and broad spectrum of understandings in other fields

Competency to take the initiative in ones special research area of natural science

3. Learning Goals

The goals of the active learning provided in the course to obtain the competencies described in the curriculum are as follows:

- A) Mastery of deep understanding in physics and high-standard specialized knowledge through seminars and ones own study for the doctor thesis
- B) Mastery of skills to creatively establish and solve problems through the thesis study and small-group education in each state-of-the-art science laboratory
- C) Mastery of cutting-edge knowledge in intensive courses
- D) Mastery of practical skills for foreign language, academic presentations, and scientific communications through pragmatical classes, colloquiums, and overseas visits
- E) Mastery of the leadership through the planning and arrangement of international research meetings

4. IGP Completion Requirements

The following requirements must be met to complete the Doctoral Degree Program of the physics course.

1. A total of 24 credits or more acquired from the 600-level courses.

2. Meet the completion requirements from the courses specified in the Graduate Major in Physics curriculum (see Table D1 below),

• a minimum of 12 credits acquired from Major Courses,

including 12 credits acquired from Research Seminars ; and

• a minimum of 6 credits acquired from Liberal Arts and Basic Science Courses

(2 credits from the 600-level Humanities and Social Science Courses, and

4 credits from Career Development Courses).

3. Pass the doctoral thesis review and defense.

Course categ	gory	<required courses=""> Required credits</required>	<electives> Minimum credits required</electives>	Minimum credits required	Associated learning goals	Comments
Liberal arts and basic	Humanities and social science courses		2 credits			
science courses	Career development		4 credits	6 credits	D, E	
	Other courses					
Core courses	Research seminars	Seminar in Physics S3 Seminar in Physics F3 Seminar in Physics S4 Seminar in Physics F4 Seminar in Physics S5 Seminar in Physics F5 A total of 12 credits, 2 credits each from the above courses.		12 credits	А, В	
	Research-related courses					
	Major courses				C, D, E	
Total required	credits	A minimum of 24 credits in addi	tion to meeting t	the above cond	itions	

Table D1. Graduate Major in Physics Completion Requirements

Note	• Japanese Language and Culture Courses offered to International Students can be recognized
	as Humanities and Social Science Courses of the corresponding course level.
	• As for Liberal Arts and Basic Science Courses, please refer to the relevant pages.

5. IGP Courses

Table D2. Core Courses of the Graduate Major in Physics

С	ourse	Course	Co	ourse		Credits	Compete	Learning	Comments
ca	tegory	Number					ncies	goals	
Resear		PHY.Z691.R	0		Seminar in Physics S3	0-2-0	1, 2, 3	A, B	
Research seminars		PHY.Z692.R	0		Seminar in Physics F3	0-2-0	1, 2, 3	A, B	
ars	600	PHY.Z693.R	0		Seminar in Physics S4	0-2-0	1, 2, 3	A, B	
	level	PHY.Z694.R	0		Seminar in Physics F4	0-2-0	1, 2, 3	Α, Β	
		PHY.Z695.R	0		Seminar in Physics S5	0-2-0	1, 2, 3	A, B	
		PHY.Z696.R	0		Seminar in Physics F5	0-2-0	1, 2, 3	A, B	
PHY.P610.L			*	Advanced Writing in Physics	2-0-0	2, 3, 4	D		
Major courses		PHY.P611.L		*	Advanced Presentation in Physics	2-0-0	1 ,2, 5	D	
		PHY.P612.L			Colloquium for Physics Presentation	0-1-0	2, 3, 4	D	
	PHY.P613.L				Colloquium for Physics Presentation II	0-1-0	2, 3, 4	D	
		PHY.P614.L			Colloquium for Physics Presentation III	0-1-0	2, 3, 4	D	
	600 level	PHY.P615.L		*	Overseas Visiting Research in Physics I	0-1-0	1, 2, 3	D	
		PHY.P616.L		*	Overseas Visiting Research in Physics II	0-1-0	1, 2, 3	D	
		PHY.P617.L		*	Overseas Visiting Research in Physics III	0-1-0	1, 2, 3	D	
		PHY.P618.L			Advanced Research in Physics I	0-1-0	2	D	
		PHY.P619.L			Advanced Research in Physics II	0-1-0	2	D	
		PHY.P620.L		<u> </u>	Advanced Research in Physics III	0-1-0	2	D	

PHY.P621.L	*	Overseas Research Project in Physics I	0-1-0	1,2,3,4,5	D
PHY.P622.L	*	Overseas Research Project in Physics II	0-1-0	1,2,3,4,5	D
PHY.P623.L	*	Overseas Research Project in Physics III	0-1-0	1,2,3,4,5	D
PHY.P624.L	*	Advanced Exercises in Organizing Physics Conferences I	0-1-0	1, 2, 3	Е
PHY.P625.L	*	Advanced Exercises in Organizing Physics Conferences II	0-1-0	1, 2, 3	Е
PHY.P626.L	*	Advanced Exercises in Organizing Physics Conferences III	0-1-0	1, 2, 3	Е
PHY.P627.L	*	Advanced Exercises in Physics Presentation I	0-1-0	1, 2, 3	D
PHY.P628.L	*	Advanced Exercises in Physics Presentation II	0-1-0	1, 2, 3	D
PHY.P629.L	*	Advanced Exercises in Physics Presentation III	0-1-0	1, 2, 3	D
PHY.P630.L		Advanced Special Lectures in Physics I	1-0-0	3, 4, 5	С
PHY.P631.L		Advanced Special Lectures in Physics II	1-0-0	3, 4, 5	С
PHY.P632.L	*	Advanced Special Lectures in Physics III	1-0-0	3, 4, 5	С
PHY.P633.L		Advanced Special Lectures in Physics IV	1-0-0	3, 4, 5	С
PHY.P634.L		Advanced Special Lectures in Physics V	1-0-0	3, 4, 5	С
PHY.P635.L		Advanced Special Lectures in Physics VI	1-0-0	3, 4, 5	С
PHY.P650.L		Advanced Special Topics in Physics I	1-0-0	3, 4, 5	С
PHY.P651.L		Advanced Special Topics in Physics II	1-0-0	3, 4, 5	С
PHY.P652.L		Advanced Special Topics in Physics III	1-0-0	3, 4, 5	С
PHY.P653.L		Advanced Special Topics in Physics IV	1-0-0	3, 4, 5	С

Note :

• \odot : Required course, \bigcirc : Restricted elective, \bigstar : Classes in English

• Competencies: 1 = Intercultural skills; 2 = Communication skills; 3 = Specialist skills; 4 = Critical thinking skills;

5 = Practical and/or problem-solving skills

• The character preceding the three digits in the course number denotes the course's subdiscipline (i.e., "D" represents the subdiscipline code in the course number ABC.D400.R): C: Condensed matter physics, E: Electromagnetism, F: Fundamental physics, G: General, L: Laboratory, M:

6. IGP Courses That Can be Recognized as Humanities and Social Science Courses

None

7. IGP Courses That Can be Recognized as Career Development Courses

As a general rule, students who would like their Career Development Courses to contribute to completion requirements of their doctoral degree program need to satisfy all of the specified Graduate Attributes ("GA"), including the attainment of at least four course credits, listed in Table A-1 or A-2 of the "Guide to Graduate Education and International Graduate Program (Liberal Arts and Basic Science Courses) - Career Development Courses". The status of the GA will be evaluated at the time of degree completion.

In addition to Career Development Courses, there are Major Courses that can also be recognized as such — shown below in Table D3 — which may go toward fulfilling the GA requirements.

However, note that when the corresponding Major Courses are recognized and accredited as Career Development Courses, their credits cannot be counted a second time (as Major Courses) towards degree completion requirements.

Course category	Course Number	Course		Credits	GA*	Learning goals	Comments
can be	XIP.A601	*	Advanced International Practice in Science	0-2-0	A1D		Common Course of School of Science <u>Outside</u> the Graduate Major in Physics standard curriculum
recognized as	PHY.P610. L	*	Advanced Writing in Physics	2-0-0	A1D, A2D	D	
Career Development Courses	PHY.P611. L	*	Advanced Presentation in Physics	2-0-0	A1D, A2D	D	
	PHY.P612. L		Colloquium for Physics Presentation I	0-1-0	A2D, A3D	D	
	PHY.P613. L		Colloquium for Physics Presentation II	0-1-0	A2D, A3D	D	
	PHY.P614. L		Colloquium for Physics Presentation III	0-1-0	A2D, A3D	D	

Table D3-1. Courses of the Graduate Major in Physics that can be recognized as Career Development Courses in the Academic Leader Program (ALP)

				1			
	PHY.P615.	*	Overseas Visiting Research in Physics I	0-1-0	A2D,	D	
	L				A3D		
	PHY.P616.	*	Overseas Visiting Research in Physics II	0-1-0	A 2D	D	
	L	×		0-1-0	A2D,	D	
	DURUD	+			A3D		
	PHY.P617.	*	Overseas Visiting Research in Physics III	0-1-0	A2D,	D	
	L				A3D		
	PHY.P618.		Advanced Research in Physics I	0-1-0	A0D,	D	
	L			0.0	A2D	_	
	PHY.P619.		Advanced Research in Drusies II		11210		
			Advanced Research in Physics II	0-1-0	A0D,	D	
	L				A2D		
	PHY.P620.		Advanced Research in Physics III	0-1-0	A0D,	D	
	L				A2D		
	PHY.P621.	<u> </u>	Overseas Research Project in Physics I			_	
	L	*	· · · · · · · · · · · · · · · · · · ·	0-1-0	A2D,	D	
					A3D		
	PHY.P622.	*	Overseas Research Project in Physics II	0-1-0	A2D,	D	
	L				A3D		
	PHY.P623.	_	Overseas Research Project in Physics III	0.1.0	A 2D	D	
	L	*		0-1-0	A2D,	D	
		_			A3D		
	PHY.P624.	*	Advanced Exercises in Organizing	0-1-0	A2D,	Е	
	L		Physics Conferences I		A3D		
	PHY.P625.	*	Advanced Exercises in Organizing	0-1-0	A2D,	Е	
	L		Physics Conferences II	010	A3D		
	PHY.P626.	+	Advanced Eversises in Organizing		1.50		
		*	Advanced Exercises in Organizing	0-1-0	A2D,	Е	
	L		Physics Conferences III		A3D		
	PHY.P627.	*	Advanced Exercises in Physics	0-1-0	A1D,	D	
	L		Presentation I		A2D		
	PHY.P628.	<u> </u>	Advanced Exercises in Physics			_	
	L	*	Presentation II	0-1-0	A1D,	D	
					A2D		
	PHY.P629.	*	Advanced Exercises in Physics	0-1-0	A1D,	D	
	L		Presentation III		A2D		
				I	1	1	L

 \star : Classes in English

To satisfy the Career Development requirement, credits may be acquired from courses listed above as well as from those listed under Career Development Courses (see the Liberal Arts and Basic Science Courses Guide).

*****GA : Graduate Attribute

Course	Course	Cours	e	credits	GA*	Learning	Comments
category	Number					goals	
	XIP.A601	*	Advanced International Practice in Science	0-2-0	P1D		Common Course of School of Science <u>Outside</u> the Graduate Major in Physics standard curriculum
	PHY.P610. L	*	Advanced Writing in Physics	2-0-0	P1D, P2D	D	
	PHY.P611. L	*	Advanced Presentation in Physics	2-0-0	P1D, P2D	D	
	PHY.P612. L		Colloquium for Physics Presentation I	0-1-0	P2D, P3D	D	
	PHY.P613. L		Colloquium for Physics Presentation II	0-1-0	P2D, P3D	D	
can be	PHY.P614. L		Colloquium for Physics Presentation III	0-1-0	P2D, P3D	D	
recognized as Career Development	PHY.P615. L	*	Overseas Visiting Research in Physics I	0-1-0	P2D, P3D	D	
Courses	PHY.P616. L	*	Overseas Visiting Research in Physics II	0-1-0	P2D, P3D	D	
	PHY.P617. L	*	Overseas Visiting Research in Physics III	0-1-0	P2D, P3D	D	
	PHY.P618. L		Advanced Research in Physics I	0-1-0	P0D, P2D	D	
	PHY.P619. L		Advanced Research in Physics II	0-1-0	P0D, P2D	D	
	PHY.P620. L		Advanced Research in Physics III	0-1-0	P0D, P2D	D	
	PHY.P621. L	*	Overseas Research Project in Physics I	0-1-0	P2D, P3D	D	
	PHY.P622. L	*	Overseas Research Project in Physics II	0-1-0	P2D, P3D	D	
	PHY.P623. L	*	Overseas Research Project in Physics III	0-1-0	P2D, P3D	D	

 Table D3-2. Courses of the Graduate Major in Physics that can be recognized as Career Development Courses in the

 Productive Leader Program (PLP)

	PHY.P624. L	*	Advanced Exercises in Organizing Physics Conferences I	0-1-0	P2D, P3D	Е	
	PHY.P625. L	*	Advanced Exercises in Organizing Physics Conferences II	0-1-0	P2D, P3D	Е	
	PHY.P626. L	*	Advanced Exercises in Organizing Physics Conferences III	0-1-0	P2D, P3D	Е	
	PHY.P627. L	*	Advanced Exercises in Physics Presentation I	0-1-0	P1D, P2D	D	
	PHY.P628. L	*	Advanced Exercises in Physics Presentation II	0-1-0	P1D, P2D	D	
	PHY.P629. L	*	Advanced Exercises in Physics Presentation III	0-1-0	P1D, P2D	D	

 \star : Classes in English

To satisfy the Career Development requirement, credits may be acquired from courses listed above as well as from those listed under Career Development Courses (see the Liberal Arts and Basic Science Courses Guide).

*****GA : Graduate Attribute

8. Overview of Curriculum System

				Required	elective	
	11 12	13 14	2① 2②	23 24	31 32	33 34
				Doctoro	l Thesis Res	search
	Advanced Writing in Physics PHY.P610.L	Advanced Presentation in Physics PHY.P611.L				
		Colloquium for Physics Presentation I PHY.P612.L		Colloquium for Physics Presentation II PHY.P613.L		Colloquium for Physics Presentation III PHY.P614.L
	Overseas Visiting Research in	Physics PHY.P615.L / II PHY	.P616.L / III PHY.P617.L			
	Advanced Research in Physic	s I PHY.P618.L / II PHY	.P619.L / III PHY.P620.L			
Major	Overseas Research Project in	Physics PHY.P621.L / PHY	7.P622.L / III PHY.P623.L			
Courses	Advanced Exercises in Organ	izing Physics Conferences I PH	IY.P624.L / II PHY.P625.L / III	PHY.P626.L		
	Advanced Exercises in Physic	s Presentation I PH	Y.P627.L / II PHY.P628.L / III	PHY.P629.L		
	Advanced Special Lectures in	Physics I PHY.P630.L / II PHY.	P631.L / III PHY.P632.L / IV PH	HY.P633.L		
	Advanced Special Topics in P	hysics I PHY.P650.L / II PHY.	P651.L / III PHY.P652.L / IV Pł	HY.P653.L		
Research Seminars	Seminar in Physics S3 PHY.Z691.R	Seminar in Physics F3 PHY.Z692.R	Seminar in Physics S4 PHY.Z693.R	Seminar in Physics F4 PHY.Z694.R	Seminar in Physics S5 PHY.Z695.R	Seminar in Physics F5 PHY.Z696.R

9. Example of a Standard Curriculum

				Required	elective	
	1① 1②	13 14	21 22	23 24	31 32	33 34
				Doctoro	al Thesis Res	search
	Advanced Writing in Physics PHY.P610.L	Advanced Presentation in Physics PHY.P611.L				
		Colloquium for Physics Presentation I PHY.P612.L		Colloquium for Physics Presentation II PHY.P613.L		Colloquium for Physics Presentation III PHY.P614.L
Major Courses			Overseas Research Project in Physics		Advanced Exercises in Physics Presentation	
	Advanced Special Topics in Physics		Advanced Special Lectures in Physics			
Research Seminars	Seminar in Physics S3 PHY.Z691.R	Seminar in Physics F3 PHY.Z692.R	Seminar in Physics S4 PHY.Z693.R	Seminar in Physics F4 PHY.Z694.R	Seminar in Physics S5 PHY.Z695.R	Seminar in Physics F5 PHY.Z696.R

10. Research Related to the Completion of Doctoral Theses

During the doctoral thesis research, students develop their own skills in setting up the subjects of significant importance and abilities to solve them. At the same time, communication skills in English are acquired.

In order to obtain the doctors degree, the thesis presentation and the final exam are required and are to be reviewed by referees.

Study plan	cs I		Colloquiu	(Colloquium for Physics III							
1 Semester		2 Semester		3 Semester		4 Semester		5 Semester		6 Sen	nester	
1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q	9Q	10Q	11Q	12Q	
Orientation								••	ication for nesis subm	nission/def	ense	

The criteria for examination

Following requirements must be met for the qualification

1. The contents of the work

The work is confirmed to be the world wide level of research which would contribute to the development of the field

2. The thesis

i) It contains an adequate review of the research field, described in plain language.

The relative position of the work in the specific field needs to be clear.

- ii) It is written in English.
- iii) A paper article to which the candidate has a major contribution is published in the international peer review journals, or the publication is confirmed *

* In the special case where the publication is foreseen to delay due to the editorial reason, the thesis can be approved if the paper is expected to be published within a year.

The thesis review procedure

The review committee consists of at least five faculty members in the physics course. After the thesis presentation by the candidate, the thesis is reviewed by the referees, and the final exam follows.