

## MASTER OF SCIENCE IN PHYSICS

Programme code: MSPHYS

### Degree Programme

In physics we try to reveal the secrets of nature, from the microcosm of elementary particles to the macrocosm of astrophysics. Between these two extremes there is a wealth of subjects, ranging from biophysics at cellular level and medical research to the development of new understanding in fields such as nanotechnology and climate. At present, these and many other areas are advancing in exciting ways.

### Specializations

In general, the specializations are:

- Astro and Particle Physics and Modern Field Theory
- Biophysics and Medical Physics
- Energy and Environmental Physics
- Optics and Condensed Matter Physics

Additional information about the specializations are found on the programme's webpages, <http://www.ntnu.edu/studies/msphys>

### Admission Requirements

For admission to the programme, you are required to hold a Bachelor's degree in physics, equivalent to 180 ECTS credits. Alternatively, you may be admitted with a Bachelor's degree not in physics, but with a sufficient formal background in calculus based physics (a minimum of 80 ECTS credits) and mathematics (a minimum of 30 ECTS credits).

### Learning Objectives

The Master of Science in Physics programme provides the candidate with knowledge, general competence, and analytical skills on an advanced level, needed in industry, consultancy, education, research, or public administration.

The work with the Master Thesis gives special expertise within one of the research areas represented at The Department of Physics: Astro and Particle Physics and Modern Field Theory, Biophysics and Medical Physics, Energy and Environmental Physics, and Optics and Condensed Matter Physics.

### Knowledge

The candidate

- has substantial knowledge in physics, basic knowledge in mathematics, and knowledge in supported fields like computer science.
- has some research experience within a specific field of physics, through a supervised project (the Master Thesis).
- has advanced knowledge in some areas in physics.
- is familiar with contemporary research within various fields of physics.

## Skills

The candidate

- has the background and experience required to model, analyse, and solve advanced problems in physics.
- is able to apply advanced theoretical and/or experimental methods, including the use of numerical methods and simulations.
- can combine and use knowledge from several disciplines.
- can critically and independently assess and evaluate research methods and results.
- has the ability to develop and renew scientific competence -- independently, via courses or through PhD studies in physics or related disciplines.
- is able to enter new problem areas that require an analytic and innovative approach.
- can disseminate subject matter and results to both specialists and a broader audience.

## General competence

The candidate

- understands the role of physics in society and has the background to consider ethical problems.
- knows the historical development of physics, its possibilities and limitations, and understands the value of lifelong learning.
- is able to gather, assess, and make use of new information.
- has the ability to successfully carry out advanced tasks and projects, both independently and in collaboration with others, and also across disciplines.
- has an adequate background for pursuing pedagogic education.
- has an international perspective on her/his discipline.

## Study plan for Master of Science in Physics

Courses and ECTS Credits				
	7.5	7.5	7.5	7.5
<b>2nd year 4th semester Spring</b>	Master Thesis			
<b>2nd year 3rd semester Autumn</b>	<i>Elective course</i>	<i>Elective course or Special Curriculum</i>		Master Thesis
<b>1st year 2nd semester Spring</b>	<i>Elective course</i>	<i>Elective course</i>	Experts in Teamwork	
<b>1st year 1st semester Autumn</b>	<i>Elective course</i>	<i>Elective course</i>	<i>Elective course</i>	

The distribution of elective courses over the four semesters may be modified, in agreement with the supervisor.

**Examination:** The courses may have different examination forms, but most often an examination, oral or written, will be arranged at the end of the semester in which the course is offered.

For most examinations, including the thesis, the scale of grading is from A (highest) to E (lowest), or F (fail). Some courses are graded with “passed” or “not passed”/“failed”.

**Resit Examination:** All courses starting with the code FY and TFY have a resit examination in August. The ordinary examination is only held at the end of the semester the course is lectured. The resit examination is arranged only for candidates that can document approved absence or candidates that obtained the grade F or Failed at the ordinary examination.

**Exchange Studies:** It is possible to do studies at other universities during the Master’s Programme. Exchange studies have to be planned in collaboration with the supervisor, and approved by The Faculty of Natural Sciences and Technology. If exchange studies are considered, they are recommended to be done in the second semester. Exchange studies in the spring semester gives exemption from Experts in Teamwork.

## Information about the Master’s Study

### Workload and structure

The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

1. A written thesis of the project (Master thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis has to be submitted within May 15<sup>th</sup> of the 2nd year.
2. An approved selection of courses, a minimum of total 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

### Master’s agreement

Every master student has to make a Master’s agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master’s study. The subjects, compulsory or elective, stated as syllabus in your Master’s agreement cannot be changed. If there for serious reason develops a need for change, the Master’s agreement must be revised. The supervisor, the responsible Department and the student must agree upon the revision and the new agreement filed.

### The Master thesis

The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc. from other sources (including the scientifically literature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to best practice within your field of study.

## Submission and Examination

The student has to:

- Register for the final master's degree exam (through STUDWEB) within February the 15<sup>th</sup> of the 2<sup>nd</sup> academic year
- Apply for approval of your individual special syllabus. It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form.
- Hand in the thesis (within the deadline given) for print through [DAIM](#). The Department will give you 5 copies of the thesis.

In addition to the judgment of thesis, the candidate will have an oral exam consisting of:

- A conversation on/presentation ("defence") of the research assignment (the Master's Thesis)
- Examination on the special syllabus of the advanced courses which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All exams, except the special syllabus (if any) have to be passed before the date of the final Master's Degree exam, unless otherwise stated in your Master's agreement.

A grade is given for every course/special syllabus that constitutes a part of the exam.

## Important deadlines

- **15<sup>th</sup> of October (1<sup>st</sup> year):** Decide on a Master's project in cooperation with the supervisor.
- **15<sup>th</sup> of October (1<sup>st</sup> year)** Register your Master's agreement in [DAIM](#) and hand in the signed agreement, a project description and risk assessment of the project.
- **15<sup>th</sup> of February (2<sup>nd</sup> year):** Deadline for registration for the final Master's Degree exam (through STUDWEB)
- **15<sup>th</sup> of May (2<sup>nd</sup> year).** Deadline for the submission of the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is handed in an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. Alternatively such an application may be dealt with, taken into consideration The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7. See below for further information regarding §7 and §23.3.
- **15<sup>th</sup> of June (approximately, 2<sup>nd</sup> year):** is the date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

**Leave of absence from the Master Study (UTF § 7) (extract):**

- a) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.
- b) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

**Prolongation of the study (UTF § 20.3) (extract):**

The master thesis is time limited. In case of illness, the deadline for handing in the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

**Course list**

The list below gives an overview of courses on 2000- and 3000-level offered by the Department of Physics. Detailed course information is available at <http://www.ntnu.edu/physics/courses>

<b>Code</b>	<b>Name</b>	<b>Semester</b>	<b>Level</b>
FY2045	Quantum Mechanics I	Autumn	2000
FY2290	Energy Resources	Spring	2000
FY2302	Biophysics I	Autumn	2000
FY2450	Astrophysics	Spring	2000
FY3006	Sensors and Transducers	Autumn	3000
FY3114	Functional Materials	Autumn	3000
FY3201	Atmospheric Physics and Climate Change	Spring	3000
FY3403	Particle Physics	Autumn	3000
FY3452	Gravitation and Cosmology	Spring	3000
FY3464	Quantum Field Theory I	Spring	3000
FY3466	Quantum Field Theory II	Autumn	3000
FY3490	Physics, Special Syllabus	Autumn/ Spring	3000
TFY4185	Measurement Techniques	Autumn	2000
TFY4190	Instrumentation	Spring	3000
TFY4195	Optics	Spring	3000
TFY4200	Optics, Advanced Course	Spring	3000
TFY4205	Quantum Mechanics II	Autumn	3000
TFY4210	Quantum Theory of Many-Particle Systems	Spring	3000
TFY4220	Solid State Physics	Spring	3000
TFY4225	Nuclear and Radiation Physics	Autumn	3000
TFY4230	Statistical Physics	Autumn	2000
TFY4235	Computational Physics	Spring	3000
TFY4240	Electromagnetic Theory	Autumn	2000
TFY4245	Solid State Physics, Advanced Course	Spring	3000
TFY4255	Materials Physics	Autumn	3000
TFY4260	Cell Biology and Cellular Biophysics	Spring	3000
TFY4265	Biophysical Micro Methods	Autumn	3000
TFY4275	Classical Transport Theory	Spring	3000
TFY4280	Signal Processing	Spring	3000
TFY4292	Quantum Optics	Autumn	3000
TFY4300	Energy and Environmental Physics	Autumn	2000
TFY4305	Nonlinear Dynamics	Autumn	3000
TFY4310	Molecular Biophysics	Autumn	3000
TFY4315	Biophysics of Ionizing Radiation	Spring	3000
TFY4320	Medical Physics	Spring	3000
TFY4330	Nano Tools	Spring	3000
TFY4335	Nano Life Science	Autumn	2000
TFY4340	Mesosopic Physics	Spring	3000
TFY4345	Classical Mechanics	Spring	3000