

# General syllabus for third-cycle studies in theoretical physics

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**Scope:** 240 higher education credits

**The Degree:** Degree of Doctor

**Study level:** Third-cycle

**Established by:** Programme syllabus established by the Faculty of Science and Technology Board on 04/10/2007; revised on 20/03/2014

**Enters into force:** 04/10/2007

**Responsible body:** Faculty of Science and Technology

### 1. Learning outcomes

#### *Learning outcomes for the degree in question*

(Higher Education Ordinance, Chapter 6, Sections 4 and 5)

#### **Knowledge and understanding**

For the degree of Doctor of Philosophy the third-cycle student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field, and
- demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

#### **Competence and skills**

For the degree of Doctor of Philosophy the third-cycle student shall

- demonstrate the capacity for scholarly analysis and synthesis as well to review and assess new and complex phenomena, issues and situations autonomously and critically
- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work
- demonstrate through a dissertation the ability to make significant contribution to the formation of knowledge through his or her own research

- demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and in society in general
- demonstrate the ability to identify the need for further knowledge and
- demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

### **Judgement and approach**

For the degree of Doctor of Philosophy the third-cycle student shall

- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how this is used.

### ***Local learning outcomes for the degree in question***

#### **Knowledge and understanding**

For the degree of Doctor of Philosophy the third-cycle student shall

- demonstrate in-depth knowledge within any of the possible specialisations within the field of theoretical physics, such as nonlinear physics, plasma physics, quantum physics or space physics.

#### **Competence and skills**

For the degree of Doctor of Philosophy the third-cycle student shall

- demonstrate ability in oral and written presentation in English, and ability to discuss research and research results in English, primarily within the fields of physics represented in the department,
- demonstrate ability to identify questions, and to plan and describe future projects in such a way that this can form the basis of applications to those financing research work.

#### **Judgement and approach**

For the degree of Doctor of Philosophy the third-cycle student shall

- demonstrate ability to convey information regarding physics and natural science to the general public in a manner that provokes interest.

## **2. Entry requirements and prior knowledge required**

### ***General entry requirements***

To be admitted for studies at third-cycle level the applicant is required to have completed a second-cycle level degree, or completed course requirements of at least 240 credits, of which at least 60 credits are at second-cycle level, or have an equivalent education from abroad or equivalent qualifications.

Applicants who meet the general entry requirements that applied prior to 1 July 2007, i.e. at least 120 credits or the equivalent, meet the current general entry requirements up to and including 30 July 2015.

### ***Specific entry requirements***

To fulfil the specific entry requirements to be admitted for studies at third-cycle level within the subject of theoretical physics, the applicant is required to have completed courses within the field of physics comprising at least 120 credits.

If special reasons exist, for example, if the planned research work has a strong interdisciplinary **element**, then the Head of Department may consent to up to 30 of these 120 credits being replaced by courses within another relevant field of natural science.

The prior knowledge requirements in respect of the above are also deemed to be fulfilled by applicants who in some other system either within Sweden or abroad have acquired largely equivalent skills.

## **3. Selection process**

### ***Selection process***

The selection among those applicants who meet the entry requirements will be conducted with reference to their ability to successfully perform third-cycle studies, and is based on the following assessment grounds:

- personal suitability
- previous study results and
- other merits

However, applicants must not be given preference over other applicants in the selection process solely based on the assessment that the applicant can receive accreditation for previous education or professional activities. (Higher Education Ordinance, Chapter 7, Section 41)

Decisions regarding admissions to studies at third-cycle level concluding in a doctoral degree are made in accordance with Umeå University's delegation of authority.

## **4. Contents and scheduling**

### **4.1 General**

An individual study plan is to be established for each doctoral student which shall give details of financing, supervision, courses, thesis-related work, etc. For a degree of doctor to be awarded, the studies shall entail 240 credits. A doctoral student who is admitted for third-cycle studies that are to conclude with a doctoral degree can, if he/she so wishes, study for a licentiate degree as an intermediate goal.

Studies in theoretical physics at third-cycle level that are to be concluded with a doctoral degree shall comprise a net study period of four years and consist of a course component of 90 credits and a doctoral thesis of 120 credits. For a licentiate degree, a total of 120 credits is required, with a course component of at least 45 credits and a licentiate thesis of at least 60 credits.

### **4.2 Contents**

#### *4.2.1 Courses*

Third-cycle studies in theoretical physics consist of a course component of at least 90 credits, which is divided up so that 10 credits are constituted of mandatory courses, and 80 credits of elective courses.

Mandatory courses for the doctoral degree: Courses that develop general skills amounting to 10 credits. 8 of these credits are to consist of courses within philosophy of science, ethics and conduct, oral presentation and a written presentation.

The elective courses are chosen by the student in consultation with the supervisor and can be largely adapted to the student's interests and area of specialisation.

The following are examples of elective courses: astrophysics, physics' mathematical methods, statistical mechanics, quantum field theory, simulation engineering, quantum transport theory, quantum information, biological physics, systems biology, relativity theory, electrodynamics, kinetic plasma theory, statistical physics, quantum electronics, solid state theory, Monte Carlo methods and nonlinear physics. Generic courses can also be included within a doctoral degree.

#### *4.2.2 Doctoral thesis*

The doctoral thesis may either take the form of a single coherent work (a monograph) or a compilation of a number of academic essays incorporating an introduction, a summary and discussion of the essays (compilation thesis) and is to comprise at least 120 credits.

The doctoral thesis shall be defended verbally in public. The thesis is assessed with the following grades: G (Pass) or U (Fail). When setting the grade, attention will be paid to both the content of the thesis and its defence.

## **5. Examination**

The degree of doctor can be awarded following the student's completion of third-cycle studies equivalent to 240 credits within theoretical physics, and where the applicant has received the grade of pass for the tests included in the studies in addition to writing and publicly defending a doctoral thesis approved by the Examining Committee. Degree certificates are issued following application to Student Services/Examina.

## **6. Other instructions**

The provisions that apply in respect of third-cycle studies can be found in:

- The Higher Education Ordinance: Chapter 5 Employment of doctoral students, Chapter 6 Courses and study programmes, and Chapter 7 Admission to courses and study programmes, Annex 2 Qualifications ordinance.
- Admission regulations for doctoral studies at Umeå University (Ref. no. FS 1.1.2-25-14).
- Local system of qualifications at Umeå University (Ref. no. 500-2958-11).
- Regulations for doctoral studies at Umeå University (Ref. no. 500-953-13).
- Handbook for postgraduate students at the Faculty of Science and Technology at Umeå University.