



LUND UNIVERSITY

Faculty of Science

Faculty Board

## **General Syllabus for Third Cycle Studies in Astronomy and Astrophysics, MNASTF00**

*This is a translation of the general syllabus approved in Swedish.*

**This syllabus was approved by the Board of the Faculty of Science on 30 May 2007 and most recently amended by the Faculty Board on 18 December 2013. The syllabus, including the amendments, applies to third-cycle students admitted from 1 July 2007.**

**The syllabus is based on the Higher Education Ordinance (1993:100) Chapter 6 Sections 1–11, 25–36, Chapter 7 Sections 34–41 and Annex 2 Qualifications Ordinance.**

### **1. Available degrees**

The programme described in this syllabus can lead to one of the following degrees:

Doctor of Philosophy in Astronomy and Astrophysics  
Licentiate of Philosophy in Astronomy and Astrophysics

In consultation with the Faculty of Engineering/LTH, the Faculty Board has decided (NA35 643/2005) that students admitted to third-cycle studies at the Faculty of Science on the basis of an MSc in Engineering shall be entitled to be awarded the degrees of Doctor of Philosophy in Science or Licentiate of Science without special application.

### **2. Subject description**

The subject of Astronomy and Astrophysics explores phenomena and structures in the universe in scales ranging from the entire visible universe to individual planets and details in our own and other planetary systems. A general aim is to understand the emergence and development of structures such as galaxies, stars and planetary systems as a result of physical processes in accordance with universal laws of nature. Some of the processes take place in extreme conditions that cannot be simulated in laboratories, which provides unique opportunities to test theories of physics. Another important function of Astronomy is to investigate the possibilities of extra-terrestrial life and environments conducive to life.

The development of Astronomy and Astrophysics is to a large extent determined by the interplay of observation and theory. A range of different instruments on earth and in space are used to make astronomical observations. Advanced

computer systems and software help to control the instruments and collect and analyse the data. Computers are also important tools for theoretical research as complex physical processes, instruments and observations can be simulated by means of numerical models. The development of new and improved instruments and methods for observation and analysis is an important part of the research in the field.

As a result of the manifold phenomena studied, Astronomy and Astrophysics has developed numerous interfaces with adjacent fields, such as with theoretical high-energy physics for the study of the origins of the universe, with geophysics for the study of conditions within the solar system and with biology for the inquiries into life on other planets.

The current research areas are described on our website [www.astro.lu.se](http://www.astro.lu.se).

### **3. Objectives**

Third-cycle courses and study programmes shall be based fundamentally on the knowledge acquired by students in first- and second-cycle courses and study programmes, or its equivalent. In addition to the requirements for first- and second-cycle courses and study programmes, third-cycle courses and study programmes shall develop the knowledge and skills required to be able to undertake autonomous research.

The third-cycle programme in Astronomy and Astrophysics aims to train doctoral students to be able to conduct research of a high international standard in a limited area of the field and work with advanced tasks within, for example, higher education or international research and development projects. A further aim is that the doctoral students, on completion of the programme, shall have acquired good, general and inquisitive expertise within science or technology that can be used for advanced tasks in areas outside academia, such as in industrial development.

The general outcomes for third-cycle courses and study programmes are defined in the Higher Education Ordinance Annex 2 Qualifications Ordinance .

#### **3.1. Outcomes for a degree of Doctor**

##### ***Knowledge and understanding***

For the degree of Doctor 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 the third-cycle student shall

- demonstrate the capacity for scholarly analysis and synthesis as well as the ability 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 thesis the ability to make a 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 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 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 it is used.

**3.2. Outcomes for a degree of Licentiate*****Knowledge and understanding***

For a Degree of Licentiate the third-cycle student shall

- demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field of research in particular.

***Competence and skills***

For a Degree of Licentiate the third-cycle student shall have:

- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work

- demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general, and
- demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

### ***Judgement and approach***

For a Degree of Licentiate the third-cycle student shall

- demonstrate the ability to make assessments of ethical aspects of his or her own research
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

## **4. Admission requirements**

The requirements for admission to third-cycle courses and study programmes are that the applicant meets the general and specific entry requirements that the higher education institution may have laid down, and is considered in other respects to have the ability required to benefit from the course or study programme.

### ***General admission requirements***

A person meets the general entry requirements for third-cycle courses and study programmes if he or she:

1. has been awarded a second-cycle qualification, or
2. has satisfied the requirements for courses comprising at least 240 credits of which at least 60 credits were awarded in the second cycle, or
3. has acquired substantially equivalent knowledge in some other way in Sweden or abroad.

The head of department may permit an exemption from the general entry requirements for an individual applicant, if there are special grounds.

*Transitional provision:* Those who meet the general admission requirements for doctoral programmes before 1 July 2007 will also be considered to meet the general admission requirements for third-cycle courses and study programmes until the end of June 2015.

If a specific number of credits or a qualification from previous first- or second-cycle courses and study programmes are required for admission to third-cycle courses and study programmes, those with corresponding credits or qualifications from undergraduate programmes awarded before 1 July 2007 will also be eligible.

### ***Specific admission requirements***

To be admitted to the third-cycle programme in Astronomy and Astrophysics the student must have a degree in subjects such as physics, mathematics and/or corresponding engineering subjects. In addition to 60 credits in basic physics, the degree must include at least 60 credits in subjects of relevance to Astronomy and Astrophysics, e.g. courses in astronomy or other physics subjects, or engineering subjects such as space technology and automatic control. The 120 credits must include 60 credits from the second cycle. The degree must include a degree project comprising 30 credits.

Equivalent knowledge acquired through corresponding programmes will be assessed individually.

In order to enable interdisciplinary initiatives and important specialisations in certain areas, students with qualifications in subjects other than Astronomy and Astrophysics may be considered for admission.

## **5. Selection**

In selecting between applicants who meet the requirements, their ability to benefit from the course or study programme shall be taken into account. However, the fact that an applicant is considered able to transfer credits from prior courses and study programmes or for professional or vocational experience may not alone give the applicant priority over other applicants.

The following selection criteria will be applied:

Study record from undergraduate and Master's courses or the equivalent. The breadth, depth and relevance of undergraduate and Master's courses or the equivalent. The quality of the degree project and other independent work.

Other knowledge and skills of relevance to the research specialisation.

Suitable candidates should be called to an interview, if possible.

The recruitment and selection to third-cycle studies must always take diversity and gender balance into account, in compliance with the Lund University gender equality policy, equal opportunities policy and diversity plan. The underrepresented gender should always be given precedence in cases of equal qualifications, unless there are valid reasons to the contrary.

Furthermore, it must be possible for the department to offer expert supervision in the student's research specialisation.

## **6. Degree requirements**

The completion of the third cycle programme results in a degree of Doctor of Philosophy or, if the student so wishes or if this is stated in the admission decision, a degree of Licentiate. The student may also but is not obliged to complete a degree of Licentiate as a stage in the third-cycle programme.

The degree of Doctor comprises 240 credits and the degree of Licentiate 120 credits.

For a degree of Doctor or Licentiate the research student must have successfully completed a PhD or Licentiate thesis and passed all courses and other components specified below. The head of department (or person to whom the task has been delegated) is to check and determine if all the formal requirements of a degree of Doctor or Licentiate have been satisfied.

### **6.1. Thesis**

The programme is to include a research project documented in a PhD or Licentiate thesis. The thesis is to be defended orally at a public defence and reviewed by a faculty examiner (opponent).

#### ***PhD thesis***

The PhD thesis is to comprise 180 credits.

The PhD thesis can be designed as *compilation thesis* or as a *monograph*.

A compilation thesis consists of copies of a number of research articles or manuscripts and a summarising chapter. The articles may be written by the doctoral student individually or in cooperation with others, but the summarising chapter must be written individually by the doctoral student. The research articles must be of a quality required for publication in recognised peer-reviewed journals and it must be possible to determine the contributions of different authors. The summarising chapter is to consist of an introduction to the research area of the thesis and a presentation and discussion of the findings of the articles. The presentation and discussion shall be written in a form and style that is independent and different from the articles. This makes it possible to situate the findings in a wider context.

A monograph thesis is a unified report including descriptions of the research issue, research questions, methods, analysis, findings and discussion.

#### ***Licentiate thesis***

The Licentiate thesis is to comprise 75 credits.

The Licentiate thesis can be designed as a summary of at least one research article (or manuscript), written by the student individually or in cooperation with others, or a unified research report (monograph). The thesis must be of a quality required for publication in recognised peer-reviewed journals and it must be possible to determine the contributions of different authors. For more information on summary and monograph theses, please see compilation thesis and monograph thesis above.

## **6.2. Courses and other programme components**

The courses and other components of the third-cycle programme in Astronomy and Astrophysics are to comprise 60 credits for a degree of Doctor and 45 credits for a degree of Licentiate.

The required courses and other components can be offered at Lund University or at other higher education institutions. The head of department (or person to whom the task has been delegated) determines the number of credits that can be transferred from courses and other components offered at other faculties or higher education institutions.

### *Compulsory courses*

An introductory course to research studies comprising 1.5 credits, of which 0.5 credits is for all doctoral students at the Faculty of Science, is compulsory. Doctoral students who teach must take a course in higher education teaching and learning of 3 credits.

### *Elective courses and other components*

In choosing elective courses and other components, the students should seek to achieve a balance between courses that broaden their general knowledge of Astronomy and Astrophysics or adjacent areas and courses that provide specialisation within areas of relevance to the thesis topic. As a guideline, a doctoral degree should include at least 20 credits of broadening courses and at least 20 credits of specialisation courses. The remaining credits can be used for more general components, such as programming or faculty-wide courses.