

STUDY GUIDE ASTRONOMY 2010-2011

Master Programme

UNIVERSITY OF GRONINGEN

Faculty of Mathematics and Natural Sciences
School of Science and Technology
Kapteyn Astronomical Institute

The information in this study guide can also be found on the Internet:

www.rug.nl/sterrenkunde

More detailed information, such as timetables of classes and examinations, can also be found through this Internet address.

Composition:
F.J. van Steenwijk

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1 General Information

1.1 Introduction

This study guide contains information on programmes, facilities, important university offices, financial matters, rules and regulations etc. for master students in Astronomy for the academic year 2010-2011.

Data liable to change during the academic year, such as schedules for classes and examinations, and detailed information about the contents of the courses can be found through the website of the Kapteyn Institute:

www.rug.nl/sterrenkunde

In case of individual situations or circumstances for which this study does not provide sufficient information, it is advised to consult the student counsellor.

1.2 Degree in Astronomy

The University of Groningen offers the opportunity to study Astronomy as a degree course. Graduates of this master programme are awarded the degree Master of Science (M.Sc.). The equivalent Dutch degree is "Doctorandus (Drs)".

1.3 Faculty of Mathematics and Natural Sciences

The Faculty of Mathematics and Natural Sciences comprises three schools and 10 research institutes.

The schools are:

- the School of Science and Technology
- the School of Life Sciences
- the School of Information Sciences

The research institute for astronomy is:

- the Kapteyn Astronomical Institute

The scientific staff of the Kapteyn Astronomical Institute takes part in the teaching activities of the School of Science and Technology.

1.4 School of Science and Technology

The master degree course in Astronomy is part of the School of Science and Technology. Other master's programmes the School of Science and Technology offers include Physics, Applied Physics, Mathematics, Chemistry, Chemical Engineering and Industrial Engineering and Management.

The board of the School of Science and Technology is constituted as follows:

- dr. H. Hanson, chair and director
- prof. dr. R.M. Scheek (Chemistry)
- prof. dr. ir. E. van der Giessen (Physics)
- prof. dr. M. Mendez (Astronomy)
- dr. ir. B.J. Kooi (Industrial Engineering and Management)
- prof. dr. G. Vegter (Mathematics)
- T.D. Huijskes (student)

1.5 Kapteyn Astronomical Institute

Department chair

prof. dr. J.M. van der Hulst

Director for Educational Affairs

prof. dr. M. Mendez

Student counsellor for master students

prof. dr. S.C. Trager

Course Committee (opleidingscommissie, OC)

Matters related to the course curriculum are discussed in the Course Committee. The Course Committee has an advisory responsibility with respect to the content of course programmes, with respect to the evaluation of course units and with respect to various other educational issues that may arise. The Course Committee also reviews the Teaching and Examination Regulations (OER) annually. The committee advises to the Board of the Faculty, to the Board of School of Science and Technology, to the Director for Educational Affairs or to individual professors.

The course committee consists of four staff members and four student members, but also the director for educational affairs, the bachelor student counsellor and the coordinator generally attend the meetings of the committee. Student members of the OC are elected annually; staff members hold office for two years.

- prof. dr. R.F. Peletier, chairman
- ms. M.G. Alberts, secr.

Board of Examiners

All faculty members (permanent scientific staff) in Astronomy are members of the Board of Examiners for Astronomy. The Board of Examiners is responsible for examinations and verifies whether individual students have met the criteria for graduation. The Board of Examiners can also make decisions regarding exemption of courses or other parts of the curriculum and other special regulations. Chairman of the Board of Examiners is:

- prof. dr. R. van de Weygaert

1.6 Student Organizations

Fysisch-Mathematische Faculteitsvereniging (FMF)



The FMF is the student association for students in (Applied) Physics, Astronomy, (Applied) Mathematics and Computer Science. The FMF organizes several formal activities as well as informal activities such as parties and sports events. Every month the FMF organizes a free cinema and informal drinks.

The FMF also organizes study related activities; colloquia, talks, seminars and study trips. The last foreign study trip went to Argentina and Brazil where a group of 25 students visited local companies and universities as well as cultural activities for three weeks. This year we're visiting Hungary for ten days.

Do not hesitate to visit us or to join activities!

Fysisch-Mathematische Faculteitsvereniging

Office: Nijenborgh 4 - room 5111.0053

Tel.: 050 - 363 4155

E-mail: Bestuur@fmf.nl

Internet: www.fmf.nl

1.7 Professional Organizations

Nederlandse Astronomenclub (NAC)

The NAC (Dutch Astronomy Club) is first of all an association for professional astronomers, but bachelor and master research students can be 'aspirant-members'. The association organises scientific meetings once or twice a year. In addition the yearly 'Dutch Astronomers Conference' is held under the auspices of the NAC.

Website: www.astronomenclub.nl

Contact persons in Groningen:

prof. dr. P.D. Barthel

Tel.: 050-363 4086

E-mail: pdb@astro.rug.nl

prof. dr. M.C. Spaans

Tel.: 050-3634094

E-mail: Spaans@astro.rug.nl

Koninklijke Nederlandse Vereniging voor Weer- en Sterrenkunde (KNVWS)

The KNVWS is the association for amateur astronomers and meteorologists. Members monthly receive the popular scientific magazine ZENIT. This publication includes introductory articles of Dutch astronomers. There are national work groups for amateur practice in some areas of astronomy and national meetings are organised. One can only become a member of the division Groningen. This division organises a.o. lectures, film evenings, observation nights and excursions. Further information about the divisions can be obtained from Drs. Th. Jurriens, Johan Ellenbergerstraat 29, 9746AK Groningen, tel. 050-573 29 37.

Koninklijke Nederlandse Vereniging voor Weer- en Sterrenkunde

Administration: Institution 'de Koepel', Observatory 'Sonnenborgh'

Zonnenburg 2, 3512 NL Utrecht

Tel.: 030-231 13 60

Website: www.astro.rug.nl/~nvws/

Contribution: Depends on the section one chooses, average € 20,- per year, (see link "Adressen, contributies" on the website). Subscription to the popular scientific monthly ZENIT costs € 55,- per year.

1.8 House rules, regulations

Fire and accidents

In case of fire or an accident call 8050 and clearly explain the situation and the location of the fire or accident.

Insurance

All students are insured via the university. This insurance consists of a collective accident insurance in combination with a collective third-party insurance during presence on grounds and in buildings (including labs) of the Rijksuniversiteit Groningen.

Cafeteria rules

The cafeteria is opened every work day from 08.45 till 16.15 (Fridays till 15.30). Used plates, cups, saucers and cutlery should be handed in at the window of the scullery. Plastic cups and such should be discarded in the litter bins. Smoking is prohibited in the cafeteria.

1.9 Computer screens and RSI

Many students spend a lot of time in front of computers and are at risk of developing RSI-troubles. RSI is the abbreviation for Repetitive Strain Injury and is a generic term for all

troubles involving neck, shoulders, arms, wrists and hands. These troubles can become chronic and lead to incapacitation for work and serious limitations in everyday life.

Symptoms

RSI symptoms can vary from stiffness, pain and tingling sensations to loss of strength in the above mentioned body parts. Initially the symptoms occur only during work in front of screens, but at a later stage they occur also when at rest. Eventually the troubles might occur continuously, causing pain at even the simplest of actions or making them completely impossible.

How to prevent RSI?

- Do not work at a computer for more than 6 hours a day
- Regularly relax your shoulders
- Sit up straight, use the arm rests
- Hold the upper arms vertically along the upper body
- Place the monitor, keyboard and document holder right in front of you
- Keep your wrists straight, if necessary by means of a wrist support or ergonomic keyboard

When using a mouse:

- Make the movements from your elbow rather than from your wrist
- Operate the mouse with your other hand every now and then
- Place the mouse close to you.

2 Facilities

2.1 Libraries

2.1.1 University Library (UB)

The UB functions as facility centre for the entire university community; for both the faculty- and institutional libraries and the library users.

The UB offers students many services. It contains more than 2.4 million books and articles. There are around 1600 places for study. Furthermore, the library holds vast collections of references and educational material. About 30% of these are available at the study rooms. The remaining material is kept at closed depots. The material can be accessed via the loan facility. For further information and services of the UB one may refer to the website.

University library
9712 CP Groningen
www.rug.nl/bibliotheek
tel.: + 050 363 5020

2.1.2 Library FWN

The library of the Faculty of Mathematics and Natural Sciences (Library FWN) serves research and education of staff and students of FWN. Furthermore, the Library FWN is open to all staff of the Rijksuniversiteit Groningen, to all students associated with the university and all guests of the library.

Library card

Staff can apply for a library card at the library. Students can use their student card as a library card.

Borrowing

Books and bound journal volumes can be borrowed for a period of four weeks. Bibliographies, reference books (like encyclopaedias, manuals and dictionaries) and current issues will not be lent out as a rule.

Practical information Library FWN

Address: Nijenborgh 9, 9747 AG Groningen
Telephone: 050 – 363 4126 (loan- and information counter)
Opening hours: Monday-Friday, 9.00 - 17.00 hours
E-mail: bibliotheekfwn@rug.nl
Website: <http://www.rug.nl/bibliotheek/locaties/bibFWN>
Facilities: Photocopiers are present at the 1st and ground floor. Printer and scanner are present at the 1st floor.
Copy/print cards are available at the library counter.
6 Carrels, 1 study group workroom, 1 instructionroom, 120 study places (63 are provided with computers) and 6 reference pc's.

2.2 Computer facilities provided by the university

Account

With your enrolment as a student of the university you will receive a letter with a student number and a preliminary password to access a computer account called the UWP (Universitaire WerkPlek). A student-account basically provides a number of common services all accessible with one username and password:

- access to the central servers for use of MS-Windows based applications
- access to the Internet and remote storage facilities
- an e-mail account

- access to Nestor (the electronic learning environment of the Rijksuniversiteit Groningen); and access to ProgRESS WWW where you can register for courses or monitor your study progress.

E-Mail

Your login name is your student number prefixed by an 's'. This login name is used in your mail address (e.g. s123456@student.rug.nl), but for mail addresses an alias with a real name is also provided.

At <https://salsa.service.rug.nl/wachtwoord.html> you can change your password. Students usually access their mail with a web browser but mail can also be read using mail protocol IMAP.

The details will be sent in a letter but can also be found on the internet.

ProgRESS WWW

ProgRESS WWW is a web application designed for students who want to access their course results or want to register for courses and exams. The course results are refreshed several times a week; a few days after a final grade has been registered by the administrations office, the grade will also appear on ProgRESS WWW. If you need an official transcript (grade report), you can print the course results and ask a secretary in the administration office for a stamp and signature.

Nestor

Nestor is the electronic learning environment (ELO) of the University of Groningen. Nestor, contains information like study guides, lecture notes, assignments and other relevant documents. It has a *Discussion Board*, a forum used by students to exchange information and a *Drop Box* to share files with fellow students such as a group assignment that has to be reviewed by students in your group.

Ocasys

Ocasys is the university course catalogue. It contains short descriptions of course contents, necessary literature, etc. The web address is: www.rug.nl/ocasys

More information

For more information about network, security, available applications, helpdesk etc., have a look at: www.rug.nl/studenten/ictvoorzieningen/index

The computer group at the Kapteyn Institute has only a limited helpdesk function for problems related to the UWP.

2.3 Computer facilities at the Kapteyn Institute

In general, astronomy students will make intensive use of the computer facilities at the Kapteyn Institute. Almost all relevant software related to astronomy runs on computers installed with UNIX/Linux. Also the environment for the development of software for astronomy is based on this platform. Therefore it is important that astronomy students get acquainted with the computer systems and programs at the institute in an early stage of their study. They get a computer account to access the Linux machines at the institute in addition to their university account. The institute's account is traditionally the same for both students and staff. There are no restrictions on using mail, personal web pages, remote access, backup, (bulk)storage and available software.

For an introduction to the computer facilities, there is an extended computer course for bachelor students. It includes an introduction to Python as the main programming language for courses with computer exercises.

Students start using the computers in the computer cluster (room number 5419.0142). This is an air conditioned room with up-to-date computer systems, all connected to the local network and accessible from any other computer (e.g. at home).

A large HD television screen and an interactive whiteboard are available for presentations. Each desk has a power- and network adapter to facilitate laptop users. For students who need to access their university account, a Windows machine with the UWP is also available.

Master students and bachelor students who started with their research project get their own desk and work space in one of the student rooms. Each desk is equipped with a workstation for personal use. These computers usually have a lot of local disk space to speed up data processing for large data volumes.

The computer group at the Institute has a helpdesk for hardware related problems (contact either W. Zwitter, room 5419.0172 or E. Tiesinga, room 5419.0194) and software related problems (contact either H. Terlouw, room 5419.0176 or M. Vogelaar, head of the group, room 5419.0180).

2.4 Blaauw Observatory

In 2008 the Blaauw observatory was opened. This observatory is located on top of the Bernoulliborg (Nijenborgh 9). It is used for educational purposes as well as for demonstrations to the general public. The central instrument of the observatory is the Grataama telescope, a 40 cm mirror optical telescope of the type Ritchey-Chrétien.

Information about the telescope can be found at the website:

<http://www.rug.nl/sterrenkunde/sterrenwacht/index>

3 Study Affairs

3.1 Academic calendar

The academic year 2010/2011 starts on September 6, 2010 and concludes on July 15, 2011. The academic year consists of two semesters each consisting of two quarters of ten or eleven weeks. Vacations are from the second week of July until the last week of August and the two weeks including Christmas and New Year. In August there is some opportunity to take examinations that were not passed in the preceding quarter (resits). Information on timetables can be found on the website: <http://www.rug.nl/fwn/onderwijs/roosters/index>

3.2 Information channels

Website of the department

The website <http://www.rug.nl/sterrenkunde> contains a fount of information about education and research. The information behind the button 'Education' (Onderwijs) does not only give you information from this catalogue, but also the latest detailed information on (examination) timetables.

Mail/Notice

In some cases messages of importance to students or groups of students, like requests to sign up for certain courses or alterations in the timetables, are sent to the electronic mailbox of the students concerned. The students are for this reason expected to check their mailbox on a regularly base (at least once a week!)

Student counsellor

See section 3.6

University paper (Universiteitskrant, UK)

The Executive Board (College van Bestuur) frequently publishes the central rules and regulations in this paper. This mainly concerns tuition fees, scholarships and the graduation fund. Furthermore, the UK contains columns with announcements of departments of the faculty of Mathematics and Natural Sciences among those of other faculties. The weekly issue of the UK can be found in the entrance hall of the Physics and Chemistry Building.

3.3 Study and finances

Tuition fees

You can only participate in the Master programme as a full-time student.

For EU students younger than 30 years of age the annual tuition fee amounts to € 1672,- .

For EU-students of 30 years of age or older the annual tuition fee amounts to € 2122,-.

For non-EU students the annual tuition fee amounts to € 9500,-.

All these fees pertain to the academic year 2010-2011.

Fees do not include travel, accommodation, living and incidental costs (about € 8000,- per year). The Housing Office assists foreign students in finding accommodation.

Deadline for applications

Applications for admission to the MSc-programme in Astronomy by foreign students should be completed as early as possible, but should have reached the university admissions office (Mrs. G.A. Sanders, admissions@rug.nl) before April 15.

Study expenses

Costs of textbooks and educational tools are relatively low. For the master programme € 1000,- will cover most of the compulsory textbooks, manuals, practical materials, excursions, etc. The University of Groningen has a policy regarding study expenses. The

purpose of this policy is to regulate study expenses in a way that they do not exceed the component 'study expenses' in the Dutch student's budget, as determined by the Minister of Education. For 2010-2011 these study expenses are set to € 675. It is sometimes inevitable to exceed this maximum sum. Half of the extra expenses can then be reclaimed from the Faculty Board (Faculteitsbestuur), or an arrangement will be made. Contact the study counsellor and Student Service Desk for a brochure about study expenses, the university's policy regarding prices and further information. The direct study costs for the master programme in Astronomy are estimated well below the maximum (appr. € 500,- per year).

3.4 Study Abroad

All master students are in principle eligible to studying abroad.

What are the possibilities?

- Following courses at a foreign university
The University of Groningen has exchange agreements with a number of foreign universities, which means that no fees will be raised if Groningen students study there for a mobility period.
For more information: see
<http://www.rug.nl/natuurkunde/onderwijs/studereninhetbuitenland/index>
- Research project at a foreign university
Generally this should be done in a research group abroad with existing ties with the research group in which you are doing your final research project. Contact your thesis supervisor for the possibilities.

Financing the study or internship abroad

There is a number of programmes to finance your study or internship, such as

- Socrates/Erasmus for study at a university within the EU,
- Marco Polo Fund for all other destinations and for travel expenses for internships, in case these are not paid for by the company.
- Groninger Universitair Fonds (GUF).

Important websites for general information and how to finance your study or internship are

- www.wilweg.nl
- www.nuffic.nl
- www.beursopener.nl

De coordinator for study abroad is:

Dr. F.J. van Steenwijk (undergraduate coordinator)

5111.0079 (Nijenborgh 4), tel. 3634782;

f.j.van.steenwijk@rug.nl

3.5 Student counsellor

The main task of the student counsellor is to provide assistance to students experiencing personal and academic problems. In practice, issues such as choice of courses, study methods, choice of (future) research specialization, optional courses and career perspectives can be discussed.

Student counsellor for master students in Astronomy is prof. dr. S.C. Trager
(S.C.Trager@rug.nl, room 5419.0182, tel. 050-3634011).

3.6 Examinations and Graduation (Tentamens en Examens)

Examinations

Astronomy examinations for most advanced courses are generally scheduled by the teachers in consultation of the students. Check the master's catalogue of Physics for how to enrol physics examinations. The course grades can be found on ProgressWWW.

Fraud

Any act of a student to mislead the examiner in such a way that a correct evaluation of the students knowledge, insight or competences is prevented, is considered as fraud.

Examples of fraud are:

- the use of crib notes (on paper or digital);
- plagiarism (also the use of internet files without proper reference is considered as fraud);
- 'free riding' on the work of fellow students in group assignments;
- copying (laboratory) reports from fellow students;
- falsifying experimental data;

In case of fraud the Board of Examiners can exclude a student from participating in the particular exam for a period of one year.

Graduation

In order to graduate from the Master's program in Astronomy, the student has to pass for every course (including thesis research) in the course curriculum. To pass means that the final grade for the course has to be at least 6. The Board of Examiners will decide on an individual basis whether the curriculum and the grades of the student meet all requirements for graduation.

Graduation is only possible for enrolled students. It is strongly advised that the student files a request for graduation as soon as all requirements of the curriculum have been met, in order to prevent unnecessary tuition costs.

Graduation ceremony

The graduation ceremony usually takes place in the Academieggebouw, Broerstraat 5. After proper registration the student will receive a schedule with time and place of the ceremony. At the graduation ceremony the graduate receives a graduation certificate together with a diploma supplement stating the grades on the separate course units.

Usually the graduation date (= the date on the graduation certificate) coincides with the date of the graduation ceremony. In some cases (usually around September 1) the graduation ceremony may be postponed to September. This may be the case when the last examination results are obtained in the last weeks of August and the administrative procedures for graduation cannot be timely fulfilled before August 31 (i.e. before the end of the academic year). When the examination results do so permit, the graduation date can be set at August 31, whereas the graduation ceremony takes place in September.

For the timetable of the graduation ceremonies one should refer to the website:
<http://www.rug.nl/sterrenkunde/onderwijs/examens/examenrooster>

3.7 Rules and Regulations

Many things treated in this study are based on formal documents approved on the basis of the Higher Education Act by the the board of the university, the board of the faculty, the faculty counsel or by the board of examiners. In case of doubt or in case of conflicts it is advisable the refer to these formal documents. Of importance are the following:

Student Charter

The Student Charter provides an overview of the rights and obligations of both students and the University. It is based on national legislation, particularly the Higher Education and

Research Act (WHW), supplemented by regulations that are specific to the University of Groningen. These latter regulations are set out in the appendices to the Student Charter. The Act stipulates that the Student Charter comprises two sections: a university-wide section and a programme-specific section.

The university-wide section describes the rights and obligations that apply to the university as a whole, such as registration and protection of rights. You can find this section on the internet (www.rug.nl/studenten/ > Legal position > Students' Charter).

The university-wide section of the Student Charter does not literally quote the articles from acts and regulations but describes them as clearly as possible. The various topics are accompanied by links to the relevant articles of the act or regulation in question.

The programme-specific sections describe the rights and obligations that apply to specific degree programmes. These sections include the Teaching and Examination Regulations (OER), Rules and Regulations for examinations and final assessment and other regulations and provisions set by the various degree programmes and faculties. You can consult your programme-specific section at the faculty Education Offices and in the Study Guides.

Applicability

The Student Charter applies to academic year 2010-2011. The university-wide section of the Student Charter is approved annually by the Board of the University and endorsed by the University Council. In the event that the Charter challenges or contradicts any legal regulations, these legal regulations will take priority.

Publication

At the start of the academic year all students will be sent an e-mail by the Board of the University informing them where they can find the Student Charter on the internet and where they can consult a hardcopy of the Student Charter.

Using the Student Charter

All students are expected to be familiar with the contents of the Student Charter. Not complying with the rules in the Charter may affect your rights, for example the right to financial support from the Graduation Fund.

Some of these regulations may not be as hard and fixed as they sound. Rules and regulations are by definition general in character, and this Student Charter is no exception. This means that the applicability of these regulations in concrete situations and individual instances is not always a predictable and straightforward matter. Students who have registered for the first time this year may find that the regulations that apply to them are different to those for students who have reregistered. Make sure you are provided with the right information by your faculty and/or the Student Service Centre (SSC) and read the Student Charter and the associated regulations carefully!

Items in the Student Charter

The university-wide section of the Student Charter contains information on the rights and obligations of students regarding the following items:

- admission,
- registration and deregistration,
- teaching, including the binding study advice,
- examinations and final assessments,
- financial assistance,
- consultative participation,
- rules of behaviour,
- legal rights.

Teaching and Examination Regulations (OER)

The Teaching and Examination Regulations is established by board and council of the faculty. It contains a number of regulations with respect to structure and content of the educational programmes, form and frequency of examinations, admission regulations, tutoring etc.

The OER can be found at: <http://www.rug.nl/fwn/informatievoor/studenten/reglementen/oer-en/index>

Rules and Guidelines of the Board of Examiners

The Rules and Regulations of the board of Examiners contain a number additional regulations concerning examinations: e.g. registration for examinations, procedures for exemptions, assessment, fraud, etc.

3.8 Objection and appeal procedures

Mistakes are, unfortunately, sometimes made when applying rules and regulations. This is why the Students' Charter (Studentenstatuut) covers provisions to ensure lawful protection of the student. If students feel unjustly treated, they can object and lodge an appeal.

The two agencies a student can contact are mentioned in the Students' Charter:

- Higher Education Appeals Tribunal (College van Beroep voor het Hoger Onderwijs). For most matters concerning the central part of the Students' Charter (see chapter 9).
- Board of Appeal for the Examinations (College van Beroep voor de Examens). Mostly for matters concerning the decentral part of the Students' Charter (OER).

An overview of all objects and appeal procedures can be acquired from the "Dienst Algemeen Bestuurlijke en Juridische Zaken" of RuG, tel. 363 5440.

Complaints

There are many situations possible where regulations of the Students' Charter (Studentenstatuut) are not directly violated, but that make the student still feel improperly or unjustly treated. In such a case he/she can file a complaint to the following agencies:

Decentral

Each of the faculties and departments has its own (specific) complaint procedure. The student counsellor can offer direct assistance, but he/she could also forward the case to, for example, the head of the Course Committee (Opleidingscommissie) or to the director of the School of Science and Technology.

Student Service Desk

If one cannot or wishes not to contact the faculty or department, the complaint could be discussed with a student dean at Student Service Desk. He/she will act as ombudsman and mediate, and, if requested, demand inspection of dossiers or contact professionals.

4 Master programme

4.1 Introduction

To be admitted to the master programme in Astronomy, the student must have obtained the prerequisite bachelor degree in Astronomy. In case a student does not meet this requirement, but does hold a bachelor degree in a related field, e.g. in Physics, the student can in many cases still be admitted. In this case the student must consult the undergraduate coordinator to set up an individual programme to eliminate deficiencies.

4.2 Course catalogue

The electronic course catalogue OCASYS contains descriptions of all course units that are offered by the University of Groningen. The url of OCASYS is: www.rug.nl/ocasys.

It should be noted that many advanced Master's courses will be taught bi-annually. Careful planning of the master's course work is therefore required. Master courses offered by astronomical institutes elsewhere in The Netherlands can also be incorporated into the Groningen curriculum. Each year an advanced national course is offered. The topic of this course, the Interacademiale College (Inter-Academy Course) is chosen by a national committee; the course, which is nearly always taught in Utrecht, is generally taken by master students from all Dutch astronomical institutes.

4.3 Course programme

The programme comprises 120 ECTS, or two full years of study. The Kapteyn Institute offers three master tracks:

theor/obs Observational and theoretical astronomy

I&I Instrumentations and Informatics in astronomy and space research

B&P Beta, bedrijf en beleid, (Beta, business and policy), largely offered in Dutch

The table gives the ECTS credit requirements for each of the tracks.

Master's Curriculum Astronomy	theor/obs.	I&I	B&P
	ECTS	ECTS	ECTS
Basic Astrophysics course	5		
Advanced astrophysics courses	25	10	30
Optional courses in science	20		
Optional courses I&I		10	
Optional courses	10		
Principles of Measurement Systems		5	
Control Engineering		5	
Applied Signal Processing		5	
Basic Detection Techniques		5	
Astronomical Space Missions		5	
Numerical Mathematics 2		5	
Project Information Technology		10	
Industrial internship		20	
Internship B&P			40
Course in B&P			20
Master research/thesis	60	40	30
Astronomy Colloquium	p.m.	p.m.	p.m.
	120	120	120

Astronomy Colloquium

Students are obliged to attend 10 sessions.

Basic Astrophysics course

Students who completed the bachelor Astronomy in Groningen will generally have taken two from the following three basic astrophysics courses during their bachelor studies. The third one should be taken during master studies.

- Formation and Evolution of Galaxies
- Interstellar Medium
- Cosmology

These courses are offered every year.

Advanced Astrophysics Courses

	ECTS	2010/2011	2011/2012
Dynamics of Galaxies	5	x	
Stellar Structure and Evolution	5	x	
Active Galaxies	5		x
Large Scale Structure of the Universe	5	x	
High Energy Astrophysics	5		x
Basic Detection Techniques	5		x
Astronomical Space Missions	5		x
Star and Planet formation	5		x
Virtual Observations	5	x	
Inter Academy Course	5	x	x
<i>Capita Selecta:</i>			
Gravitational Lensing	3	x	
Milky way	3		x
Dark Matter in Galaxies	3	x	
Epoch of Reionisation Physics	3		x
HI in the Universe	3		x
High Redshift Galaxies	3		x
Cosmic Web	3	x	
Dwarf Galaxies	3		x

Inter-academy course/Interacademiaal college

The subject of the Inter-academy course 2010/2011 is History of Astronomy. Coordinator is prof. dr. F.W.M. Verbunt (University of Utrecht). Further information will be announced on the website www.rug.nl/sterrenkunde.

Optional Courses I&I

	ECTS	2010/2011	2011/2012
Device Physics	5	x	x
Interferometry	5		x
Virtual Observations	5	x	
Control Engineering	5	x	x
Accelerator Physics and Ion Optics	5		x
Laser Cooling and Trapping	5	x	
Experimental Methods of Trace Gas Research	5	x	x
Imaging Techniques in Radiology	5	x	x
Device Physics	5	x	x
Applied Signal Processing	5	x	x
Materials Science and Design	5	x	x
Scientific Visualisation	5	x	x

Optional courses in Science

Theoretical Physics

(ECTS)

Elementary particles	5
General Relativity	5
Introduction to Supersymmetry	5
Quantum Field Theory	5
Quantum Many Body Theory	5
Astroparticle Physics	5
Relativistic Quantum Mechanics	5
Symmetry in Physics	5
Statistical Mechanics	5
Theoretical Condensed Matter Physics	5
Advanced Quantum Field Theory	5
Student Seminar in Modern Cosmology	5
Universality in Quantum Few Body Systems	5

Applied Physics

(ECTS)

Capita Selecta Materiaalkunde	3 - 6
Device Physics	5
Fysische Materiaalkunde	5
Materiaalkunde en ontwerpen	5
Mechatronics	5
Mesoscopic Physics	5
Micromechanics	5
Principles of Measurement Systems	5
Solid Mechanics	5

Other advanced Physics courses

(ECTS)

Accelerator Physics and Ion Optics	5
Applied Signal Processing	5
Atomic Interactions	5
Astroparticle Physics	5
Electronic Structures of Materials	5
Computational Physics	5
Computer Simulation of Quantum Systems	5
Contemporary Experiments in Molecular Physics	5
Elementary Particles	5
Experimental Methods for Trace Gas Research	5
Introduction to Plasma Physics	5
Isotope Production	5
Key Experiments in Atomic Physics	5
Laser Cooling and Trapping	5
Many Particle Systems and the Quantum Theory of Solids	5
Milieufysica	5
Nuclear Physics	5
Nuclear Astrophysics	5
Non Linear Optics	5
Physics of Continuous Media	5
Radiation Physics	5
Sensors and Detectors	5
Statistical methods in Physics	5
Student Seminar on Quantum Computation	5
Student Seminar on Cosmology	5
Student Seminar on Subatomic Physics	5

Surfaces and Interfaces	5
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Student Seminars

Student Seminar on Quantum Computation	5
Student Seminar on Modern Cosmology	5
Student Seminar on Subatomic Physics	5
Fundamental Interactions and Symmetry	5

Advanced Mathematics courses

(ECTS)

Computational Fluid Dynamics	5
Dynamical Systems and Chaos	5
Functional Analysis	5
Geometry and Physics	5
Numerical Mathematics 1	5
Numerical Mathematics 2	5
Ordinary Differential Equations	5
Partial Differential Equations	5
Statistics	5
Signals and System Theory	5

Computer Science and Applied Computer Science

(ECTS)

Advanced Linear Programming	6
Computer Architecture and Networks	5
Computational Physics	5
Computational Fluid Dynamics	5
Computer Simulations of Quantum Systems	5
Numerical Mathematics 1	5
Numerical Mathematics 2	5
Programming in C/C++	5-10
Project Information Technology	10
Robotics	5

Optional courses I&I (Instrumentation and Informatics)(ECTS)

Accelerator Physics and Ion Optics	5
Applied Signal Processing	5
Applied Signal Processing	5
Basic Detection Techniques	5
Control Engineering	5
Experimental Methods of Trace Gas Research	5
Imaging Techniques in Radiology	5
Interferometry	5
Laser Cooling and Trapping	5
Materials Science and Design	5
Scientific Visualization	5
Virtual Observations	5

Chemistry and Chemical Engineering courses:

(ECTS)

Fysische Transportverschijnselen 1	5
Fysische Transportverschijnselen 2	5
Macromolecular Chemistry	5
Thermodynamica van polymersystemen	5
Technische Thermodynamica	5

Optional Courses

This can be either astronomy or other science courses or free electives. Courses not mentioned in this chapter should be chosen in consultation with the student counsellor.

4.4 Further Information on the specialization Instrumentation and Informatics in Physics, Astronomy and Space Research

The specialization 'Instrumentation and Informatics in Physics, Astronomy and Space Research' aims at students in Physics, Applied Physics and Astronomy who want to specialize in advanced instrumentation and informatics. Specialists in this field are of great value in fundamental and applied research in several areas of astronomy and space research. For instance, at the University of Groningen, this specialization constitutes a collaboration with the 'Kapteyn Laboratorium', the 'National Institute for Space Research (SRON)', ASTRON, the Nuclear Accelerator Institute and the Centre for Isotope Research.

The course curriculum of the specialization Instrumentation and Informatics can be found in chapter 4 and contains a number of mandatory courses in instrumentation and informatics, optional courses and further courses in astronomy, physics and applied physics. The Master's research project is carried out in one of the above mentioned research institutes and should be astronomy oriented. Students considering specializing in Instrumentation and Informatics are recommended to take a minor Instrumentation and Informatics in the bachelor programme.

4.5 Further Information on the Specialization Science, Business and Policy

The specialization Beta, Bedrijf en Beleid (Science, Business and Policy) is a specialization of almost every Master's programme offered by the FWN. The aim of this specialization is to combine knowledge and insights from other disciplines, in particular management, organization and public administration.

The combination of Astronomy and Business and Policy is created for students interested in working for a (medium or big) science-oriented company.

The first year of the specialization is aimed at deepening the knowledge of physics and astronomy. The second and final year consists of the course 'Bèta in Beleid en Bedrijf' and the combined internship/research project 'Bèta, Beleid en Bedrijf'.

The course 'Bèta in Beleid en Bedrijf' offers an introduction into the disciplines 'Management and Organization' and 'Public Administration'. You will apply the knowledge you have acquired in this course to multidisciplinary projects assigned by companies and the government.

The core of the combined internship/research project 'Bèta, Beleid en Bedrijf' consists of an internship of six months with a company of institution. An internal internship at the university is also among the possibilities. The internship deepens the knowledge you acquired during the course 'Bèta in Beleid en Bedrijf' and offers an in depth introduction and practice with project management. The internship will be enriched with lectures, training sessions and exchange of experiences and briefings during two introductory weeks and an evaluation week.

The specialization Bèta, Bedrijf en Beleid is conducted in the Dutch language, and is therefore not accessible to those who have no command of this language.

For more information on this specialization, please consult: Drs. A.J. Abma (lecturer and coordinator), tel. 050 363 2263, a.j.abma@biol.rug.nl, or go to: www.rug.nl/fwn/mvariant/.

4.6 Admission to the master programme in case the bachelor programme is not yet completed

If the bachelor programme in Astronomy is not yet completed, it is not possible to enroll formally into the master's programme in Astronomy. However it is allowed to follow courses of the master programme if the remaining amount of credits of the Bachelor's curriculum does not exceed 15 ECTS. Moreover, the student should have completed the propaedeuse and should have to have passed all practicals and research projects. The remaining 15 ECTS have to be completed within one semester.

5 Contact data

5.1 University contact data

Board of the University (CvB)

Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 5285

University Council (U-raad)

Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 8535
E-mail: uraad@rug.nl
Internet: www.rug.nl/uraad

Legal Affairs Office (ABJZ)

Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 5440
E-mail: abjz@rug.nl
Internet: www.rug.nl/bureau/expertisecentra/abjz

Donald Smits Center for Information Technology (CIT)

Visiting address: Zernikeborg, Nettelbosje 1
Postal address: P.O. Box 11044, 9700 CA Groningen, the Netherlands
Telephone: (050) 363 9200
E-mail: secretariaat-cit@rug.nl
Internet: www.rug.nl/cit
CIT Helpdesk:
Telephone: (050) 363 3232
E-mail: servicedesk-centraal@rug.nl

Health, Safety and Environment Service (AMD)

Visiting address and postal address: Visserstraat 49, 9712 CT Groningen, the Netherlands
Telephone: (050) 363 5551
E-mail: amd@rug.nl
Internet: www.rug.nl/amd

Office of the Confidential Advisor

Marijke Dam, Confidential Advisor
Visiting and postal address: Visserstraat 47, 9712 CT Groningen, the Netherlands
Telephone: (050) 363 5435
E-mail: j.m.dam@rug.nl
Internet: www.rug.nl/vertrouwenspersoon

Complaints Committee for harassment, sexual harassment and aggressive, violent or discriminatory behaviour

Postal address: Antwoordnummer 172, 9700 AB Groningen

Student Service Desk

Visiting address: Broerstraat 5
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 8004
Internet/e-mail: www.rug.nl/hoezithet, www.rug.nl/insandouts

International Service Desk (ISD)

Visiting address: Broerstraat 5
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands

Telephone: (050) 363 8181
E-mail: isd@rug.nl
Internet: www.rug.nl/isd

Student Counsellors, a department of the Student Service Center
Visiting address: Uurwerkersgang 10
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 8004
Internet/e-mail: www.rug.nl/ssc

Psychological Counselling Service, a department of the Student Service Center
Visiting address: Uurwerkersgang 10
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 5544
E-mail: studentenpsychologen@rug.nl
Internet: www.rug.nl/ssc

Centre for Study Support and Academic Skills (SO), a department of the Student Service Center
Visiting address: Uurwerkersgang 10
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 5548
E-mail: y.m.robert@rug.nl
Internet: www.rug.nl/ssc

Talent and Career Center (T&CC)
Visiting address: Munnekeholm 2, 9711 JA Groningen
Postal address: P.O. Box 7117, 9701 JC Groningen, the Netherlands
Telephone: (050) 311 1589
E-mail: info@talentcareercenter.nl
Internet: www.talentcareercenter.nl

Board of Appeal for Examinations (CBE)
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 5439

University Funds Committee (UFC)
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
E-mail: ufc@rug.nl

5.2 Kapteyn Institute

Telephone number = 050 - 363 + Extension

	Extension	E-mail (...@astro.rug.nl)	Kamer (5419.0...)
Department Chair Prof. dr. J.M. van der Hulst	4054	J.M.van.der.Hulst	150
Director for Educational Affairs Prof.dr. M. Mendez	4093	M.Mendez	154
Secretariat			
M.G. Alberts	4079	secr.	178
H.P. Zondervan-Kimsma	4075	secr.	178
J.I. Zwegers-Morris	4073	secr.	178
undergraduate coordinator Dr. F.J. van Steenwijk	4782	f.j.van.steenwijk@rug.nl	5111.0079
Student counsellor			
bachelor students: Prof dr. E. Tolstoy	8323	E.Tolstoy	195
master students: Prof. Dr. S.C. Trager	6625	S.C. Trager	158
Ms. M.G. Alberts	4079	gineke	178
Staff members			
Albada, prof.dr. T.S. van	4082	T.S.van.Albada@astro.rug.nl	182
Alberts, mw. M.G.	4079	M.G.Alberts@astro.rug.nl	178
Barthel, prof.dr. P.D.	4064	P.D.Barthel@astro.rug.nl	
Begeman, dr. K.	2454	K.Begeman@astro.rug.nl	129
Boxhoorn, drs. D.R.	2454	D.R.Boxhoorn@astro.rug.nl	129
Bruyn, prof.dr. A.G. de	4057	A.G.de.Bruyn@astro.rug.nl	152
Douglas, dr. N.G.	4088	N.G.Douglas@astro.rug.nl	188
Gorkom, prof.dr. J.H. van	8325	J.H.van.Gorkom@astro.rug.nl	144
Helmi, dr. A.	4045	A.Helmi@astro.rug.nl	190
Helmich, drs. E.M	4548	E.M.Helmich@astro.rug.nl	133
Helmich, dr. F.P.	4799	F.P.helmich@astro.rug.nl	294
Hulst, prof.dr. J.M. van der	4054	J.M.van.der.Hulst@astro.rug.nl	150
Jones, prof.dr. B.	4087	B.Jones@astro.rug.nl	187
Kamp, dr. I.	4070	I.Kamp@astro.rug.nl	175
Koopmans, dr. L.V.E.	6519	L.V.E.Koopmans@astro.rug.nl	160
Kruit, prof.dr. P.C. van der	4062	P.C.van.der.Kruit@astro.rug.nl	164
McFarland, dr. J.P.	8326	J.P.McFarland@astro.rug.nl	147
Méndez, prof.dr. M.	4093	M.Mendez@astro.rug.nl	285
Morganti, dr. R.	4080	R.Morganti@astro.rug.nl	179
Oosterloo, dr. T.A.	4080	T.A.Oosterloo@astro.rug.nl	179
Peletier, prof.dr. R.F.	6647	R.F.Peletier@astro.rug.nl	141
Roelfsema, dr. P.P.	4043	P.R.Roelfsema@astro.rug.nl	293
Shipman, dr. R.F.	7753	R.F.Shipman@astro.rug.nl	286
Spaans, prof.dr. M.C.	4094	M.C.Spaans@astro.rug.nl	196
Tak, dr. F.F.S. van der	8753	f.f.s.van.der.tak	294
Terlouw, dhr. J.P.	4068	J.P.Terlouw@astro.rug.nl	176
Tiesinga, dhr. E.	4017	E.Tiesinga@astro.rug.nl	194

Tolstoy, prof.dr. E.	8323	E.Tolstoy@astro.rug.nl	195
Trager, dr. S.C.	6625	S.C.Trager@astro.rug.nl	158
Valentijn, prof.dr. E.A.	4011	E.A.Valentijn@astro.rug.nl	139
Verdoes Kleijn, dr. G.	8326	G.Verdoes@astro.rug.nl	147
Verheijen, dr. M.A.W.	4077	M.A.W.Verheijen@astro.rug.nl	284
Vogelaar, drs. M.G.R.	4096	M.G.R.Vogelaar@astro.rug.nl	180
Voort, dr. L. van der	4076	L.van.der.Voort@astro.rug.nl	166
Vriend, drs. W.J.	2535	W.J.Vriend@astro.rug.nl	133
Weijgaert, prof.dr. M.A.M. van de	4086	R.van.de.Weygaert@astro.rug.nl	186
Wild, dr. W.	6243	W.Wild@astro.rug.nl	290
Zaroubi, prof.dr. S.	4055	S.Zaroubi@astro.rug.nl	282
Zondervan-Kimsma, mw. H.	4075	H.Zondervan- Kimsma@astro.rug.nl	175
Zwitser, dhr. W.	4071	W.Zwitser@astro.rug.nl	162