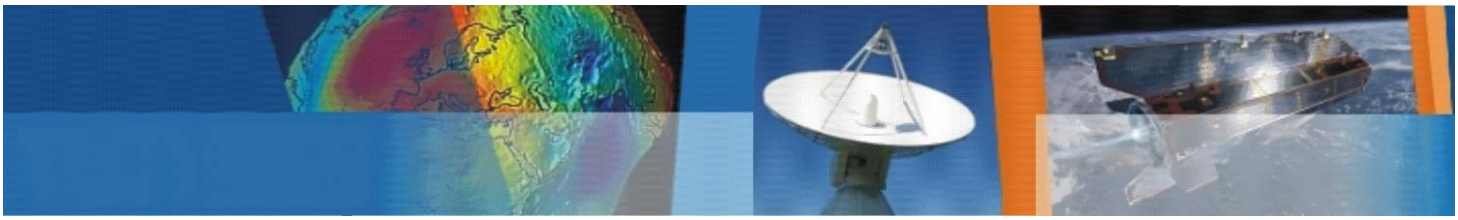
Technische Universität München

Study Handbook

ESPACE

Master of Science (M.Sc.)

Academic Year 2017-2018



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Disclaimer

This study handbook was put together by administrators and faculty of the ESPACE M.Sc. program with attention to detail. Some items however could be subject to change after its publication for logistical reasons. Students are therefore expected to keep themselves informed of any changes or updates from the ESPACE website, www.espace-tum.de and the TUM website, www.tum.de.

Foreword

Dear Student,

Welcome to the ESPACE Master's program at the Technische Universität München (TUM)! We hope that this Study Handbook will provide you with answers to many of the questions you may have during your studies. Throughout this handbook, we aim to inform you in detail about the program's background, its curriculum, study requirements, and regulations. It is intended as a reference that can be carried with you for easy access should you need it.

Chapter one covers the background of the ESPACE program, detailing how it was founded as well as outlining its objectives. After describing which kind of students the program is aimed at (target group) as well as the contributing institutions which are an integral part of the program, the chapter concludes with a summary of the professional fields students can expect to enter upon completing their studies in ESPACE.

Chapter two provides students with the program's curriculum and covers the program contents by semester. This chapter includes information on orientation week, including cultural transitioning, projects, presentations, and teamwork, all components of success for the program. Finally, detailed module descriptions are given following an explanation of the credit system.

The third chapter is dedicated to general graduation requirements and to specific requirements for exams and the master's thesis and colloquium. This chapter also highlights the importance of academic honesty.

Chapter four introduces the ESPACE Double Degree Program with Wuhan University, China. This program gives ESPACE students the opportunity to study one year in China and thereby obtain two MSc degrees – one from Wuhan University and one from the TUM.

In the Appendix you will find practical information such as an academic calendar, maps, and TUM office contact information.

Should you have any questions about the contents of this handbook, please do not hesitate to ask us. We hope that you find the handbook to be a convenient resource of information.

We wish you much success here in the ESPACE program and in all your future endeavours.

Sincerely,

The ESPACE Team

The ESPACE Team Welcomes You!

Professor Roland Pail, Programme Director

Professor Pail is Study Programme Director for ESPACE. He has been with the ESPACE Programme since 2010 and lectures in the ESPACE modules Earth System Science (1st semester) and Seminar with Guest Lecturers (3rd semester)

Dr Dorota Iwaszczuk, Degree Programme Coordinator and Student Academic Advisor

Dorota has been Degree Programme Coordinator for ESPACE since 2013 and lectures in modules Applied Earth Observation and Mission Engineering (2nd semester) Earth Observation Satellites (3rd semester). In addition, she is in charge of academic advising to the students and is the contact person for scientific and program content inquiries.

Dr Thomas Gruber, Degree Programme Coordinator (Deputy)

Dr Gruber has been working with ESPACE since 2005. He lectures in the ESPACE modules Applied Computer Science (1st semester), Projects in Earth Oriented Space Science and Technology (2nd semester). He is also supporting the coordination of the ESPACE Master's programme.

Mr Rene Schneider, Exam administrator

Mr Schneider has been exam administrator for ESPACE Master's program since November 2016. He is in charge of management of the exam grades in TUMonline including registration and deregistration, study progress monitoring, medical certifications, Master's thesis registration and other related issues.

I) Introduction to the M.Sc. ESPACE Program

Background and Objectives

Satellite applications

Earth observation satellites help us better understand and monitor our environment. Orbiting spacecraft enable us to view large areas of Earth's surface and to obtain a global coverage not possible with in-situ measurements. Orbital spacecraft serve as "eyes in the sky" and can therefore provide us with a variety of useful information.

Satellite data is the key for studying the ***Earth system***. Satellites support geo-scientists with environmental data on ocean, atmosphere, ice or glaciers. This kind of data provides the basis for understanding and modelling processes and interactions among the various components of the Earth system, such as atmosphere, hydrosphere, cryosphere, biosphere and the Earth's interior. Verified by observations over many years, such models allow for predictions of global climate change and its impact on human life.

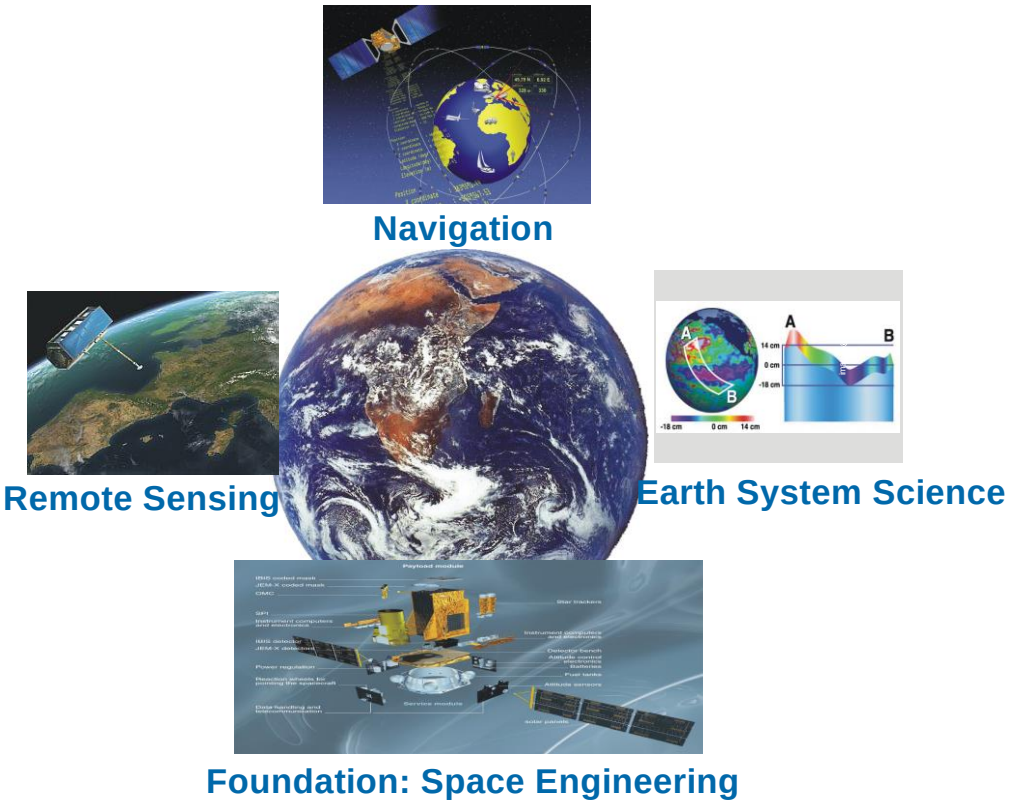
Remote sensing satellites carry instruments measuring electromagnetic emissions in various spectral bands that show which kind of objects, such as clouds, ocean and lakes, vegetation and mountains, are present. A variety of sensors, such as radar, lasers, thermal and optical cameras exist. These sophisticated instruments can inform us about object properties such as temperature, composition, shape and motion. Remote sensing images are very important for a range of users, such as farmers, map-makers, politicians, etc.

Navigation has been revolutionized by satellites. Today a variety of global navigation satellite systems (GNSS) exist such GPS (USA), GLONASS (Russia) and the recently installed GALILEO (Europe). They are complemented by some regional systems, e.g. over India and Japan. As soon as vehicles have a receiver, navigation for land, ocean, and air is possible with very high precision. Also modern traffic control, logistics and surveying have become inconceivable without reliable navigation systems.

ESPACE – a satellite application engineering program

Satellite data users often have little knowledge in spacecraft technology and orbit mechanics. Also many space engineers have little insight into the work of the satellite data users. Design, development and data analysis of respective satellite missions require experts with knowledge not only in space engineering but also in applications of these satellite missions. From an educational point of view, this diversity is a challenge. Classical university programs cover parts of this spectrum in different disciplines. These are aerospace engineering, electronic engineering, environmental engineering, geodesy and geophysics – just to mention a few – yet there is hardly any connection between these parts.

Therefore several institutions in and around Munich decided to combine their expertise and set up a graduate program**.** The result is the Master's program "Earth Oriented Space Science and Technology" (ESPACE), established in 2005. The aim of ESPACE is to educate satellite application engineers. Graduated students will have gained knowledge in the three *key satellite applications*; 1) Earth system science from space, 2) Remote Sensing, and 3) Navigation. Not only will they be able to interpret, analyse and evaluate satellite data for these applications, but they will also have know-how in the satellite system. This involves an understanding of the entire satellite mission, including space segment, orbit design, launcher and ground segment.



Elements of the ESPACE program: key satellite applications and foundations in space engineering.

The ESPACE curriculum consists of modules in space engineering foundations and allows students to specialize in satellite applications related to navigation, remote sensing and Earth system science from space. This combination of disciplines distinguishes ESPACE from other Master's programs in related fields.

Target group

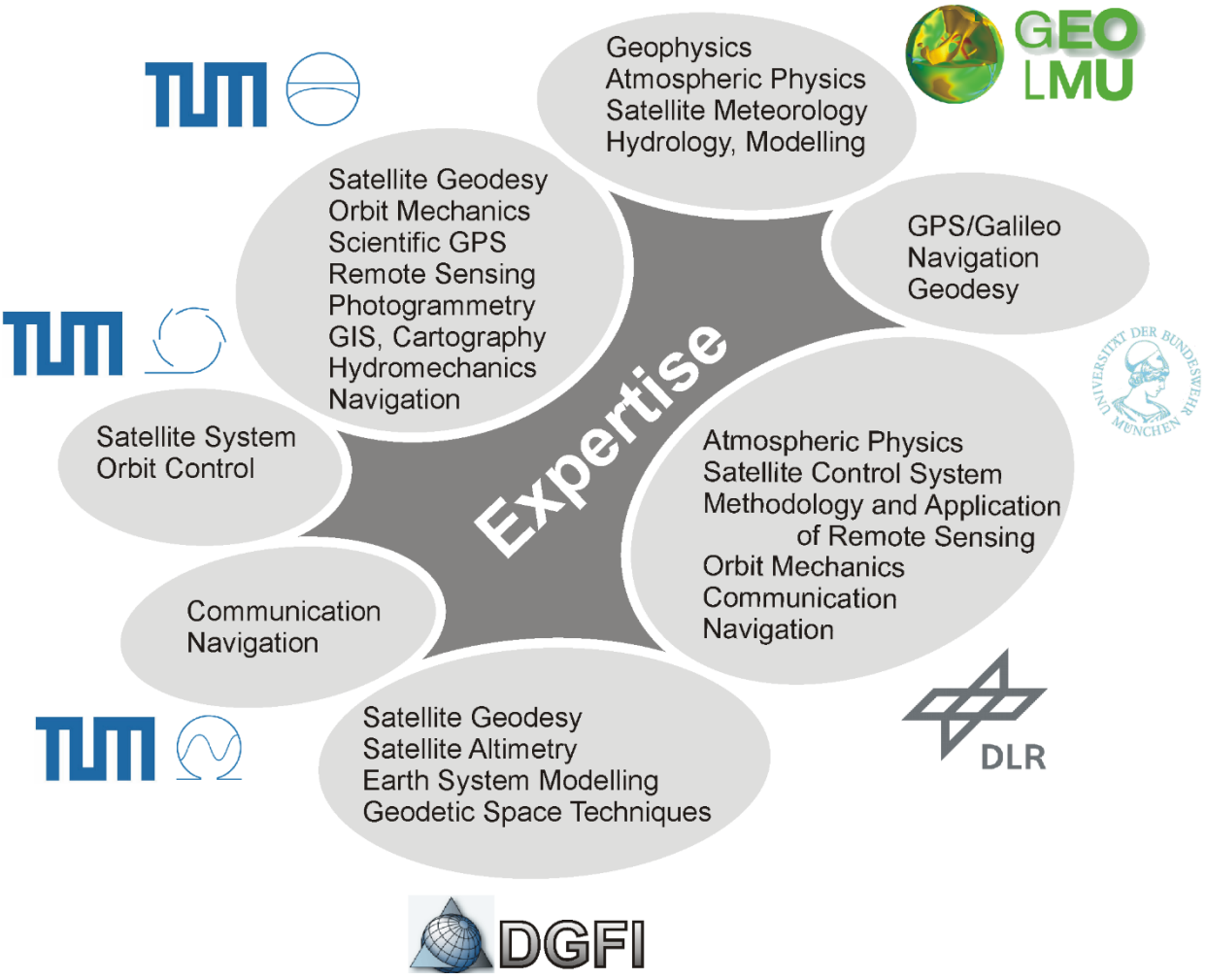
ESPACE carries out research and education in Earth oriented engineering and natural sciences. Therefore ESPACE addresses students from engineering or science programs such as mechanical, electrical, communication, environmental, or geodetic engineering, as well as geophysics, physics or mathematics. A solid background in mathematics and physics is necessary and, of course, an interest in satellites and Earth-related topics.

Contributing institutions

One of the main drivers of the establishment of the ESPACE program was the high concentration of expertise in the Munich area. Munich is one of Europe's top "space regions" with a unique concentration of know-how in satellite-related topics in research institutions, universities and industry. Main contributors to the program are

- The Technische Universität München (TUM) with the faculties of Civil, Geo and Environmental Engineering, Mechanical Engineering, Electrical Engineering, and Information Technology
- Ludwig-Maximilians Universität (LMU) with the department of Earth and Environmental Sciences
- University of the Federal Armed Forces Munich
- The German Aerospace Center (DLR)
- The German Geodetic Research Institute (DGFI)
- Space industry such as Kayser-Threde

Experienced researchers from these institutions are directly involved in ESPACE as teachers or guest lectures. The fields of expertise from each of these partner institutes are shown in the following figure. The program is hosted at and coordinated by the faculty of Civil Geo and Environmental Engineering at the TUM. The students are enrolled only at the TUM.



Life after ESPACE

The demand for young researchers in the field of Earth Oriented Space Science and Technology and space application engineering has proven to be high. The majority of ESPACE graduated students (alumni) have continued to work with research. Some have returned to their home countries for a research position, but many have also gone on to pursue a PhD in various cooperating ESPACE institutes, some in the frame of the ESPACE Graduate School. The engagement of ESPACE cooperating institutes gives the students the opportunity to establish valuable contacts with potential employers already during their studies. A period of working as a student assistant or on a Master's thesis may well result in a PhD offer right after graduation.

Although most ESPACE Alumni continue with research, some have also secured positions in the space industry, mostly in Europe. This industry is well established due to the European Space Agency (ESA) and the many strong national space agencies such as the German Aerospace Center (DLR), Centre National d'Etudes Spatiales (CNES) and Agenzia Spaziale Italiana (ASI). These in turn have paved the way for a space industry consisting of companies or consultancy firms specialized in spacecraft technology, navigation or remote sensing. The European navigation system GALILEO and the recent European initiative, Global Monitoring for the Environment and Security (GMES) have created and will continue to increase the demand for expertise with know-how in satellite application engineering.

Some words from ESPACE Alumni….,

"A very extraordinary thing about ESPACE is that the program's content is not somehow historically based. A good portion of the lecturers come from experts from research institutes, other universities, and companies. It appears to have been a thoroughly thought out program with regard to which fields of expertise would be necessary, with all the experts from these necessary fields coming to lecture for the program!"

--Volker Tesmer (class of 2008), now working in the department for space system studies of the space technology company OHB-System

"ESPACE implies going beyond the stage of being a fascinated observer of satellites and space engineering. The program enables you to become an active participant in space science who can processes data, interpret results and develop methodologies for space missions."

--Sarah Abelen, (class of 2009), Technische Universität München, International Graduate School of Science and Engineering PhD Candidate in "Signals of Climate Variability in Continental Hydrology from Multi-Mission Space and In-situ Observations"

"*The ESPACE program gave me a solid base on which I can now draw to lead debates with a broad knowledge of the Earth system. The program sparked my interest in the Earth System and I am grateful for that."*

--Delf Neubersch (class of 2010), PhD Student in the Research Unit for Sustainability and Global Change at the University of Hamburg and a stipend recipient of the International Max Planck Research School on Earth System Modelling

“ESPACE provided me with a platform to study several aspects of space science related courses and eventually specialize in one of them. I found great pride in interacting with the best minds from all over the world. The course helped me gain confidence to work independently on practical engineering problems. The program itself gave me enough opportunities to evaluate and nurture my strengths. Thanks to ESPACE, significant value is added to my career profile.”

--Ganesh Lalgudi Gopalakrishnan (class of 2010), Senior Engineer, Satellite Navigation Systems at VEGA Space GmbH, Darmstadt, Germany

"If space is the final frontier, then ESPACE was my spacecraft. The ESPACE program is perfect for those who aim to learn more about satellites and their applications both on our planet Earth and in space. It gave me an opportunity to meet the big names in this field and to work on the most current research topics. The multi-disciplinary and multi-cultural background of the students in this program presents a perfect recipe for success. As a PhD student, I can proudly say that my foundation in remote sensing is strong because of the ESPACE program."

--Gopika Suresh (class of 2011), PhD Student at the University of Bremen's Institute of Environmental Physics/Centre for marine environmental sciences doing her PhD in the field of Automatic Detection of Natural Oil Slicks in Synthetic Aperture Radar Images

“The ESPACE program gave me more than just technical education, it also showed me how people from all over the globe can share knowledge and work together in the particular field of earth sciences. This was sometimes challenging and different views on how to approach tasks collided, but by resolving these situations I gained valuable experiences for working in an international environment. There, a common language is the key to share ideas and though for the majority of us students English was not the native language, we quickly got used to it and ESPACE offered an encouraging environment to strengthen our cross-border communication skills. Another important experience for me was the interdisciplinary approach of ESPACE, demonstrated not only by the wide areas of subjects covered in its lectures, which range from satellite technique, the whole infrastructure required to make such satellite missions possible, up to the scientific analysis of the data, but also by the multitude of institutions supporting the program. Cooperation between institutions is also a key motivation for the DLR - TUM joint project I now work in as a research scientist and PHD candidate. Thus, the ESPACE program prepared me well in many ways and provides me a good basis for my future career.”

-- Christoph Gisinger (class of 2012), Institute for Astronomical and Physical Geodesy (IAPG), Technische Universität München, Research scientist and PHD candidate in the field of SAR and GNSS

“The ESPACE program has three key strengths: its lecturers, its interdisciplinarity and its location. The ESPACE lectures and high-level lecturers provide students with profound knowledge and excellent contacts for future PhD or job opportunities. The large number of disciplines and institutes involved in ESPACE force the student to the edge of many space-related science and engineering topics, both in lectures and projects, which is excellent for their learning minds and gives a lot of areas for specialization to choose from. ESPACE is located at the TUM, an elite university, and has lecturers from LMU, DLR, DGFI and other very renowned institutions at German and European level. ESPACE is based in Munich, one of the cities with highest quality of living in the world, and one of the focus cities in Europe in

education and jobs related to space technology. During my specialization in satellite navigation at ESPACE, I was given the opportunity of co-founding a start-up company with lecturers of the TUM's institute of communications and navigation. I wrote my master thesis there about algorithms for precise GNSS based attitude determination for vehicles and ships and I will continue at the company for a PhD thesis. I'm also in charge of other projects and cooperations with industry and academic partners, as well as consultancy services in satellite navigation and Earth observation for the government of my home country, Colombia, and supervision of students for internships and master theses at the company."

-- Juan M. Cárdenas (class of 2012), project coordinator, software developer for ANAVS and PhD Student at the Institute for Communications and Navigation (TUM) in the area of GNSS based attitude determination. Juan was selected as one of the 100 successful Colombians abroad in 2013 by Marca País Colombia and the association Fusionarte in Madrid.

"The ESPACE program is the ideal atmosphere that combines the expertise of high-quality lecturers and the relations with the space industry and research centers, within a renowned university. This program taught me how to build bridges between ideas, science and knowledge, from dedication and the guidance of its magnificent lecturers."

-- Raul Garcia (class of 2013) Coordinator of the mechanical engineering program and PhD student at ITESO, in Guadalajara Mexico, in the area of autonomus navigation

For more statements see your web page www.espace-tum.de -> Master's Program -> Students -> Alumni

II) Program Curriculum

Overview

Earth Oriented Space Science and Technology (ESPACE) is a 2-year international Master of Science (M.Sc.) Program. The program starts every winter term in mid-October. The ESPACE Master's program consists of compulsory, required elective and elective modules.

The program's curriculum is based on the fundamentals of satellite application engineering and concentrates on methodology and development/design.

Orientation activities:

Starting a graduate program involves challenges, particularly when starting a program in a different country and in a different culture than your own. Academic expectations, habits, and views could vary slightly or greatly depending on your country of origin. For this reason, ESPACE organizes orientation activities mainly during the week before and some weeks after the lectures start. It begins with an orientation meeting and sometimes includes a guided tour around the TUM main campus. Further a cultural competence workshop is offered (date of workshop could vary from year to year) that focuses on differing cultural expectations in an academic environment to assist in the transition to your new academic environment. Next, a 3-day long MATLAB introduction course is offered to those students with little or no experience in MATLAB. During the ESPACE program you will have to do many labs and exercises in MATLAB and already during the first semester, good know-how in MATLAB programming is required. The orientation will end with a two-day excursion to Wettzell, the geodetic observatory in the Bavarian Forest. During the Wettzell excursion, students not only become more familiar with ESPACE, but also get useful information on writing reports, giving presentations, and writing better English. Further, a guided tour is given of the station where research is conducted that is very much related to ESPACE.

1st and 2nd semester

The first two semesters contain compulsory modules for all the students. Since ESPACE students have diverse academic backgrounds, the first year strives to give the students a common theoretical base and prepare them for the specialization modules in the third semester. Emphasis is placed on space engineering in general. The offered modules cover three main areas, namely,

1) Mathematical and physical foundations, such as *Numerical Modelling, Signal Processing and Microwave Remote Sensing, and Estimation Theory*
2) Modules related to Space Engineering such as *Orbit Mechanics, On-Orbit Dynamics and Robotics,* and *Spacecraft Technology (runs over 2nd and 3rd semester)*;

3) Introductory modules to the key satellite applications such as Introduction to Earth System Science, Satellite Navigation and Advanced Orbit Mechanics, and Introduction to Photogrammetry, Remote Sensing and Image Processing
4) Modules on applied satellite data engineering such as Projects in Earth Oriented Space Science and Technology, Applied Earth Observation and Mission Engineering and Applied Computer Science

3rd semester

In the 3rd semester students deepen their knowledge by choosing a specialization in one of the key satellite applications in this semester, experienced researchers from the contributing ESPACE institutes are more involved than before as lecturers. Hence students become familiar with state-of-the-art research and are able to get valuable insight into current satellite application projects. The small number of students in some specialization's modules allows for many projects and seminars, which means that the students actively apply their gained knowledge under close supervision.

The following are the specializations each representing one of the three key satellite applications:

Specialization **Earth System Science from Space:** this specialization imparts know-how in the modelling of complex processes and contains lectures on the Earth system, oceanography, atmospheric physics, and Earth's magnetic and gravity field. Students will learn how to utilize satellite data for studies on global change and for modelling geophysical processes, e.g., in the fields of climate, water cycle or geodynamics.

Specialization **Remote Sensing:** involves the acquisition and interpretation of measurements from a variety of sensors, e.g., radar, laser, thermal or optical cameras. The specialization contains lectures on image processing, geo-information, photogrammetry and advanced remote sensing.

The specialization **Navigation** imparts advanced processing techniques and hardware aspects of precise Global Navigation Satellite Systems (GNSS). This includes the involved models and the processing strategies used for precise GNSS positioning applications. The specialization also aims to give the students practical experience with GNSS equipment, data analysis, processing concepts, etc. Further, the students get acquainted with different GNSS and navigation applications. The specific modules within each specialization along with their credits are depicted in the following figure:

Specialisations		
Earth System Science from Space	**Remote Sensing**	**Navigation**
Atmosphere and Ocean Type of Module: required elective 6 Credits	**Photogrammetry** Type of Module: required elective 6 Credits	**Precise GNSS** Type of Module: required elective 6 Credits
Earth System Dynamics Type of Module: required elective 6 Credits	**Remote Sensing** Type of Module: required elective 6 Credits	**Advanced Aspects of Navigation Technology** Type of Module: required elective 6 Credits
Earth Observation Satellites Type of Module: required elective 6 Credits	**Geo-Information** Type of Module: required elective 6 Credits	**Navigation Labs** Type of Module: required elective 6 Credits

The modules within a specialization are compulsory.

In the third semester, the students have also the possibility to select a couple of modules of their own interest. 8 credits worth of electives shall be picked from a subject catalogue. The subject catalogue will be updated each year and will contain a large variety of modules offered by the TUM.

4th semester

The Master's Thesis is an individual research work carried out under the guidance of an ESPACE lecturer. Master's Thesis topics should have a strong relation to Earth Oriented Space Science and Technology. Students are allowed to do their Master's Thesis outside the TUM, for example at one of the contributing ESPACE institutes, but in that case they need to find a supervisor among the ESPACE lecturers. When students complete their thesis, they have to defend it in a Master's Colloquium. For more information on the Master's Thesis please see Chapter III. A summary of the ESPACE Program curriculum is depicted in the following figure.

<table>
<tr><th>1. Semester</th><th>2. Semester</th><th>3. Semester</th><th>4. Semester</th></tr>
<tr><td>Introduction to Earth System Science
Type of Module: required
6 Credits</td><td>Projects in Earth Oriented Space Science and Technology
Type of Module: required
8 Credits</td><td rowspan="3">Specialisation
Type of Module: required
18 Credits</td><td rowspan="6">Master's Thesis
Master's Colloquium
Type of Module: required
30 Credits</td></tr>
<tr><td>Numerical Modeling
Type of Module: required
6 Credits</td><td>Applied Earth Observation and Mission Engineering
Type of Module: required
6 Credits</td></tr>
<tr><td>Introduction to Photogrammetry Remote Sensing and Image Prcessing
Type of Module: required
6 Credits</td><td>Satellite Navigation and Advanced Orbit Mechanics
Type of Module: required
6 Credits</td></tr>
<tr><td rowspan="2">Signal Processing and Microwave Remote Sensing
Type of Module: required
5 Credits</td><td>Estimation Theory
Type of Module: required
3 Credits</td><td rowspan="2">Electives
Type of Module: required elective
8 Credits</td></tr>
<tr><td>On-Orbit Dynamics and Robotics
Type of Module: required
3 Credits</td></tr>
<tr><td>Orbit Mechanics
Type of Module: required
4 Credits</td><td colspan="2" rowspan="2">Spacecraft Technology
Type of Module: required
8 Credits</td></tr>
<tr><td>Applied Computer Science
Type of Module: required
3 Credits</td></tr>
<tr><td>30 Credits</td><td>30 Credits</td><td>30 Credits</td><td>30 Credits</td></tr>
</table>

Summary of ESPACE Program Curriculum

Skills across various subjects

During the ESPACE program, students train skills across various subjects offered by ESPACE such as writing skills, presentation techniques and the ability to work in intercultural teams.

Team work is practiced during the many project courses, during which students have to solve a task in groups. Due to the different backgrounds of the ESPACE students, the teams are often intercultural. Most of these projects are part of the required elective modules in the third semester. At the end of the projects, students submit either a written report or give an oral presentation. In this way, writing and presenting is practiced. Presentation technique is also improved by a seminar offered in the second semester. Students need to work on a scientific topic together with a supervisor and present the work during the seminar.

ESPACE module and credits overview

The ESPACE Program is organized into modules. A module is defined as "consist(ing) of one or several thematically linked and synchronized courses pursuant to" section 6 of the TUM wide APSO (General Academic and Examination Regulations). Although most modules are composed of only one course, some consist of several courses with sometimes more than one examination. 3rd semester modules in particular contain several courses each given by different lecturers.

The program contains required, required elective and elective modules. Required modules must be taken by all students and the pertinent examinations must be successfully completed.

Each module has a certain amount of credits and hours of lectures (SWS). More information on credits and SWS can be found in Chapter 3.

Key:
L = lecture; T = tutorial (referred to as "exercise course" in the examination regulations); P = practical training; Sem. = Semester

Required Modules (1st – 3rd Semester)

Nr.	Module Name	Type of Instruction L T P	Sem.	SWS	Credits	Type of Exam	Duration of Exam (in minutes)
1	Introduction to Earth System Science	L	1	4	6	written	120
2	Numerical Modeling Coursework—Numerical Modeling	L + T	1	4	6	written	120
3	Introduction to Photogrammetry, Remote Sensing and Image Processing	L + T	1	4	6	written	120
4	Orbit Mechanics Coursework—Orbit Mechanics	L + T	1	3	4	written	80
5	Applied Computer Science	L + T	1	2	3	written	60
6	Signal Processing and Microwave Remote Sensing	L + T	1	4	5	written	75

Nr.	Module Name	Type of Instruction L T P	Sem.	SWS	Credits	Type of Exam	Duration of Exam (in minutes)
7	Projects in Earth Oriented Space Science and Technology	L + P	2	6	8	project work	
8	Applied Earth Observation and Mission Engineering	L	2	5	6	written, project work	120
9	Satellite Navigation and Advanced Orbit Mechanics	L + T	2	4	6	written	120
10	Estimation Theory	L	2	3	3	written	60
11	On-Orbit Dynamics and Robotics	L	2	2	3	written	90
12	Spacecraft Technology (not for Wuhan University participants who will complete their 5th Semester at Wuhan University	L + T	2 + 3	6	8	2* written (each 50%)	2*90
13	Introduction to Spacecraft Technology (only for Wuhan University participants who will complete their 5th Semester at Wuhan University	L + T	2	3	4	written	90

Specialization (3rd Semester)

The 3rd semester consists of **required, required elective and elective modules.**

The required elective modules allow students to specialize in either

- Earth System Science from Space or
- Remote Sensing or
- Navigation

"Required elective" means that each student must choose one of the Specializations and its related modules.

Each Specialization is composed of 3 modules**,** some of which are made up of more than one **course**. For example, Specialization 1 (Earth System Science from Space) contains the module "Atmosphere and Ocean", which is composed of the courses "Atmospheric Physics and Remote Sensing" and "Satellite Altimetry and Physical Oceanography". Together these two courses make up the total number of credits allotted to the module (in this example's case, 6 credits).

Required elective: from the following list 18 credits are to be earned (modules are in **boldface**):

Required elective modules for Specialization 1 (Earth System Science from Space)

Nr.	Module Name	Type of Instruction L T P	Sem.	SWS	Credits	Type of Exam	Duration of Exam (in minutes)
1	Atmosphere and Ocean	L	3	4	6	oral	-
2	Earth System Dynamics	L + T + P	3	4	6	written exam (75%), written reports (25%)	120
3	Earth Observation Satellites	L + T	3	4	6	written exam (50%), written reports (50%)	90

Required elective modules for Specialization 2 (Remote Sensing)

Nr.	Module Name	Type of Instruction L T P	Sem.	SWS	Credits	Type of Exam	Duration of Exam (in minutes)
1	Photogrammetry	L + P	3	4	6	written exam (50%), written reports (50%)	60
2	Remote Sensing	L + T	3	4	6	written exam (50%), written reports (50%)	60
3	Geo-Information	L	3	4	6	written	60

Required elective modules for Specialization 3 (Navigation)

Nr.	Module Name	Type of Instruction L T P	Sem.	SWS	Credits	Type of Exam	Duration of Exam (in minutes)
1	Precise GNSS	L + T	3	4	6	written exam (75%), written reports (25%)	75
2	Advanced Aspects of Navigation Technology	L	3	4	6	written exam (33%), written reports (67%)	60
3	Navigation Labs	P	3	4	6	written reports	-

Elective modules:

- 8 credits worth of electives have to be taken.
- The ESPACE Examination Board updates the subject catalogue yearly and will announce this as well as the examination details that go with them on the ESACE website at the beginning of the semester at the latest.
- Through petition and an exception made by the Examination Board, a student can, as an alternative to the above mentioned subject catalogue electives, choose a subject-relevant class in the area of an examination subject from the entire TUM's and Ludwig-Maximilians University's lecture offerings.

4th semester

The fourth semester of the program is dedicated to the Master's Thesis. More information on the thesis and colloquium can be found in chapter 3 of this handbook.

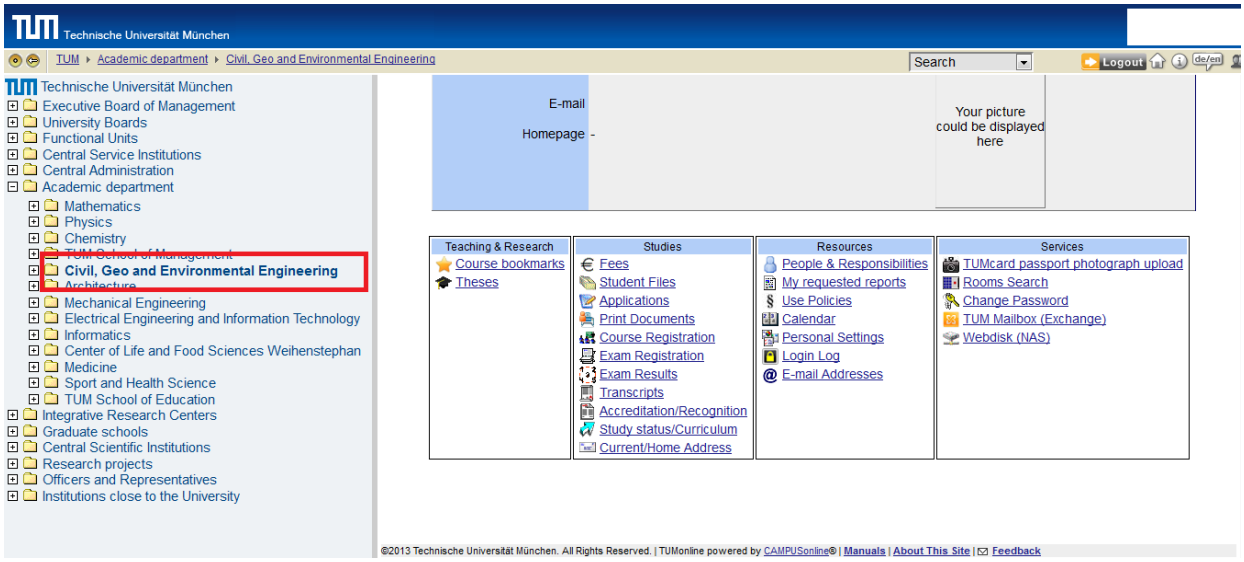
	hours per week	ECTS credits
Master's Thesis	-	24
Master's Colloquium	-	6

Module descriptions

There are two possibilities to get information about each module: TUMonline and ESPACE web page.

First, on TUMonline:

1. Choose the “Civil, Geo and Enviromental Engineering” from the list of TUM departments on the left side of your TUMonline page.



2. Select “Module Catalog” in the table.

3. Put the mark on the “Show modules according to use in SPO versions” on the page.

4. Select among the list of the TUM Programs “Earth Oriented Space Science and Technology (Master's program, **current**)” and push “Display”.
5. View a list of all modules. Select an interesting for you. Find and download the description of the selected module in the PDF format under the English version.

Second, on ESPACE web page:
www.espace-tum.de

III) Study Requirements

Graduation Requirements

Credits

In order to receive the ESPACE Master of Science degree, students must earn a total of 120 credits. This includes all required, required elective and elective modules, as well as the Master's Thesis and Colloquium.

Definition of credits

In accordance with the Bologna Process, the TUM uses the European Credit Transfer System (ECTS). 1 ECTS credit is equal to 30 hours of work on the student's behalf. More information on this can be found at https://studium-und-lehre.wiki.tum.de/C#Credits.

Grading scale

Each module is graded with grades awarded on a scale from 1,0 (best) to 5,0 (worst). In general, grades are given in increments of 1.0, 1.3, 1.7,….3.7, 4.0,etc. The grading scale is expressed as follows:

Grade	Definition
1,0 to 1,5	Very good
1,6 to 2,5	Good
2,6 to 3,5	Satisfactory
3,6 to 4,0	Sufficient
4,1 or higher	Fail

Program regulations and practical information

ESPACE has its own specific subject examination regulations (FPSO from the German acronym) in German and English. They can be downloaded from

www.espace-tum.de

For students who began their studies in Winter Semester 2011-12 and also students thereafter, the TUM's "Allgemeine Prüfungs- und Studienordnung" (APSO—in English "General Academic and Examination Regulations") are valid in reference to the ESPACE examination regulations. The APSO are the general regulations on academics for the entire TUM. ***Please be aware that only the printed versions of the German documents are legally binding.***

Examination Board

Decisions regarding exam affairs are made by the ESPACE Examination Board. The Examination Board is composed of five members: four representatives from the Faculty of Civil, Geo and Environmental Engineering ("Ingenieurfakultät Bau Geo Umwelt") and one representative from the Department of Mechanical Engineering ("Maschinenwesen"). Grades submitted by professors are confirmed by the Exam Board and then finalized before students receive their official grade lists from the TUM Exam Office.

Exams

During your studies, you will have to write following exams in required modules and required electives.

Module name	Semester	Module number
Introduction to Earth System Science	1	BV450001
Introduction to Photogr., Remote Sensing and Image Processing	1	BV480026
Numerical Modelling	1	BV570004
Orbit Mechanics	1	BV610001
Signal Processing and Microwave Remote Sensing	1	BV290016
Applied Computer Sciences	1	BV450002
Projects in Earth oriented Space Science & Technology	2	BV450021
Satellite Navigation & Advanced Orbit Mechanics	2	BV610023
Applied Earth Observation and Mission Engineering	2	BV450020
On-Orbit Dynamics and Robotics	2	MW1860
Estimation Theory	2	BV310004
Spacecraft Technology 1	2	MW198301
Spacecraft Technology 2	3	MW198302
Specialization 1: Earth System Science from Space		

Atmosphere and Ocean	3	BV450006
Earth Observation Satellites	3	BV570002
Earth System Dynamics	3	BV570001
Specialization 2: Remote Sensing		
Geo-Information	3	BV300003
Photogrammetry	3	BV480025
Remote Sensing	3	BV290015
Specialization 3: Navigation		
Precise GNSS	3	BV610003
Advanced Aspects of Navigation Technology	3	BV610005
Navigation Labs	3	BV610004

In addition, you will write exams in elective modules of your choice.

Registration

Examinations will generally be taken at the end of each semester. You should register for all required, required elective and electives exams in the TUMonline system by yourself by the deadline**. Please note: If you do not register on time, you will not be able to participate in the exam!** Please register only in your curriculum, in this way you are sure to register for the right exam for your study program.

It is your responsibility to register yourself for the exam in a timely manner. Failure to register for an exam will leave you off the list that the lecturer receives with names of students who are expected to take the exam.

Examination period

Usually, exams take place between the second and fourth week after lecture period, however this may vary due to some organizational reasons. The exam schedule is made available to you no later than two weeks before the beginning of the exam period, but usually you are informed about the exam schedule earlier than this!

It is your responsibility and yours alone to keep yourself informed about both normal and repeat exams! The exam schedule is available via TUMonline system.

Type and duration of examinations

Exams can be either oral or written, or can be a combination of, for instance, written exam and written reports. Oral exams are at least 20 minutes in duration, but no longer than 60 minutes. Written exams are at least 60 minutes but no longer than 180 minutes.

In addition or instead of an exam, some modules are completed with oral or written activities. Oral activities can mean an oral presentation at the end of a project or a presentation as part of a seminar. Written activities are usually written project reports or written lab reports. Activities are subject to the same regulations as exams.

Please be sure to bring your ID/Passport and your student card with you to the exams!

Passing exams

A module is deemed passed if it is graded with at least the grade 4,0 ("sufficient"). If the module also required coursework, the coursework has to be graded "successful" in order to pass the entire module.

Examination credit requirements

If an exam is not passed (fail grade), you may repeat the exam as often as necessary until you pass it, subject to the following conditions:

- you must have passed ***at least five exams*** by the ***end of the 2nd semester***
- you must have earned ***30 credits*** by the ***end of the 3rd semester***
- you must have earned **60 credits** by the ***end of the 4th semester***
- you must have earned ***90 credits*** by the ***end of the 5th semester***
- you must have earned ***120 credits*** by the ***end of the 6th semester***

Please note that if the examination credit requirements are not met the Master of Science degree is considered failed and you will be ex-matriculated (un-enrolled)!

Repeating exams

An exam that is ***passed*** (i.e. better than 4,3) ***cannot be repeated*** in order to improve your grade in the exam!

Repeat exam period

The ESPACE Examination Board normally sets a designated repeat exam period after it has met to confirm the grades from the previous semester. Since the Examination Board meets shortly after the beginning of each semester, this means that most repeat exams are to take place during a two week period in the following semester. The repeat exam dates and times are coordinated by the ESPACE Office and announced to the students with ample time to allow for preparation.

If you are ill for an exam

Should you become ill and not be able to appear at a scheduled exam, you must bring the ESPACE Office a doctor's certificate as soon as possible, i.e. ***on the same day as the exam itself***. In exceptional cases you can bring the certificate a few days after the exam date. However, the certificate has to be submitted, before the grades are announced. Please ensure that your doctor's certificate is ***from a doctor in Munich***. If

you do not appear at the scheduled exam and do not provide the ESPACE office with a doctor's note, the exam is graded as "failed".

Exam results

Preliminary results are posted on TUMOnline after they are graded and submitted to the ESPACE Office. These grades are tentative and are not binding or final until the Examination Board meets to confirm all grades. After this, you will be able to generate your official grade notifications via your TUMOnline account. It is important that you ***ensure that your address and any other (i.e. email address) personal information is correct in your TUMOnline account***.

TUMOnline also makes it possible for you to print out a so-called "Leistungsnachweis" which is a list of your successful (passed) classes should you need it before the official grade list is available. More information on TUMOnline can be found in the TUMOnline Handbook, available for download in English at http://portal.mytum.de/iuk/cm/studierende/index_html and www.it.tum.de/it-dienste-systeme/tumonline/

Exams and leave of absence

Regular examinations (i.e. exams in the normal exam period for the semester in which the student is taking a leave of absence) may not be taken during a leave of absence; however repeat examinations from the previous semester are allowed to be taken.

Master's Thesis and Master's Colloquium

Master's Thesis

Students should begin the Master's Thesis immediately after the successful completion of the subject examinations. Normally, the 4th semester is dedicated to the Master's Thesis.

Students should look for a possible thesis supervisor and agree on a topic. The topic should have a strong relation to ESPACE. It is recommended that you begin looking already during the 3rd semester. It is possible to write the Master's Thesis outside the TUM, for example at one of the contributing ESPACE institutes. If the supervisor is external, the student needs to find an additional supervisor among the ESPACE lecturers. The student should be aware of that the ESPACE supervisor has, even though the main work might be carried out at the external institute, the main responsibility and officially grades the Thesis.
The Master's Thesis will be assessed by the supervisor and must be written in English

Master's Thesis registration

You have to register with the ESPACE Office for the Master's Thesis ***at least one week before beginning it***. A registration and agreement form must be filled out and signed by both supervisor and student. In the agreement, the student and the supervisor(s) should agree on the content and the expected outcome of the Thesis and is therefore recommended to invest some time on it. The registration and agreement form can be downloaded from the ESPACE website. The supervisor and topic must be approved by ESPACE Program Office.

Period for Master's Thesis

The period of time between topic selection and submission of the completed Master's Thesis must not exceed ***6 months***.

Upon a student's written request, the period of time for writing the Master's Thesis may, in especially justified cases, be extended by a maximum of 3 months. Extension can be accepted only if the reason is beyond student's control. In case of extension, a written letter with a short explanation (on why the Master Thesis has to be extended) is required. This letter must be signed by both student and supervisor. Be aware that an extension of the Master's Thesis may cover an additional semester and you will have to pay the fees for the following semester!

Submission of the thesis

Please submit one printed and one digital copy of your Master's Thesis to the Institute of Astronomical and Physical Geodesy. You should use a template for the front cover and declaration. The template can be downloaded from the ESPACE website. The printed copy should be bound.

Master's Colloquium

A student is deemed registered for the Master's Colloquium if he/she has achieved a minimum of 90 credits in the Master's Program and has successfully completed the Master's Thesis. That means that all subject examinations have to be passed and the written report should be submitted before the Master's Colloquium can take place.

The Master's Colloquium is to be held in English.

The Master's Colloquium will as a rule last 60 minutes. The presentation of the Master's Thesis shall last a maximum of 30 minutes. This will be followed by a discussion that will extend to a broader discipline than the subject of the Master's Thesis.

The grade is based on both the presentation (form and content) and the discussion that follows.

Your supervisor will be present during the Master's Colloquium. The Master's Colloquium will take place at the TUM. All ESPACE lecturers and students will be invited. Students are allowed to ask questions, but must leave the room for the last part of the defence.

Academic Honesty

The Technische Universität München is a prestigious and reputable university that expects academic honesty from the members of its community. The ESPACE program also firmly believes that all work undertaken by its students must be their ***own work and nobody else's***. It is therefore important to note that, as in all academic spheres, references must be ***properly cited*** and ***credit to other authors*** must be clearly marked in any project, paper, or presentation given***. Plagiarism, or using someone else's words as your own, is also not allowed under any circumstances***. Understandably, it can be difficult to write and do coursework in a language other than your own; however, it is more important and in your favour to submit something in poor English than in perfect but plagiarized English.

Likewise, examinations must be done individually by the student and without any cheating. ***Any evidence of cheating or dishonest work, whether for examinations or coursework, will be investigated and will be subject to negative repercussions for your program of studies.*** As stated in the TUM's "General Academic and Examination Regulations" for Bachelor's and Master's Programs (APSO), "if a student attempts to alter the results of an examination by fraud, deceit, etc. or the use of unauthorized materials or resources, the examination will be graded "Fail". A student who disrupts the regular course of the examination may be suspended from the examination by the examiner or proctor; in this case the examination will be graded "Fail" (Clause 22, TUM APSO).

IV) ESPACE Double Degree Program with Wuhan University, People's Republic of China

Highly qualified ESPACE students have the opportunity to participate in a Double Degree Program with Wuhan University (WHU) in China. The program lasts three years and involves a minimum one year stay at Wuhan University. Graduates obtain not only a Master's Degree from the TUM but also a Master's Degree from the WHU.

Background and Objectives

A double degree program offers the student the chance to study partly at the home (in this case, the TUM) university and partly at a foreign university, thereby obtaining two different degrees. The period of study is often prolonged but remains short compared to the complete period of study for two single study programs. The aim is to let the student benefit from the strength of both study programs. The student is offered not only more courses, but also more contact with different teaching methods.

China is becoming an increasingly important country with enormous capabilities. The economy as well as the Chinese education system is rapidly expanding. Investments are being put into the top universities with the aim of strengthening technology and increasing contact between industry and research.

Wuhan University (WHU) is China's most prominent and largest university in the fields of Geodesy, Geo-information, and Remote Sensing. Furthermore, the "State Key Lab of Information Engineering in Surveying, Mapping and Remote Sensing (LIESMARS)" is located at the university. In 2009 an agreement for common research between LIESMARS and the Department of Photogrammetry and Remote Sensing was established. In the same year the ESPACE Double Degree Program with Wuhan University was initiated by Professor Liqiu Meng (Vice President at TUM and lecturer for ESPACE).

Wuhan University

Wuhan University, a TUM partner university, is situated in the capital of Hubei province, Wuhan, along the Yangtze River. The university has as many as 45 000 students studying varying disciplines such as philosophy, economics, law, education, medicine, and science and engineering – just to mention a few.

The following WHU schools participate in the double degree program:

- Schools of Resources and Environmental Science
- School of Geodesy and Geomatics
- School of Remote Sensing and Information Engineering

- State Key Lab of Information Engineering in Surveying, Mapping and Remote Sensing
- GNSS Research Center

Bird's view of Wuhan University Campus

Curriculum

The double degree Master's program is comprised of six semesters over three years. The students spend the first year at their home university. At least one year of studies should be spent at the host university.

For the double degree Master's program, three different curricula are scheduled. ***Two curricula (Curriculum 1a and Curriculum 1b)*** are intended for WHU students going to the TUM. ***One curriculum (Curriculum 2)*** is intended for TUM students going to the WHU. Modules of curriculum 2 are specified in this study handbook.

Curriculum 1a	
3rd year	Co-supervised Master's Thesis
	TUM
2nd year	TUM
1st year	WHU

Curriculum 1b	
3rd year	Co-supervised Master's Thesis
	WHU
2nd year	TUM
1st year	WHU

Curriculum 2	
3rd year	Co-supervised Master's Thesis
	TUM
2nd year	WHU
1st year	TUM

Curricula 1a and 1b: for WHU students going to the TUM
Curriculum 2: for TUM students going to the WHU

Curriculum 2

The time spent at the WHU takes place in the 3rd and 4th semesters. The 3rd semester contains mandatory lectures while in the 4th semester students can choose one of three specializations: Navigation, Remote Sensing, or GIS. The 5th semester will be spent at the TUM (where students will attend the courses of the regular ESPACE 3rd semester) and the 6th semester will be dedicated to a Master's Thesis. The Master's Thesis will be co-supervised by teachers from the WHU and the TUM and can optionally be carried out either at the WHU or at the TUM.

Below are the lectures offered at the WHU.

	Wuhan University Credits System	**ECTS Credits (European Credits Transfer System)**
3rd Semester (WHU)		
Comprehensive Chinese	2	4
Outline of China	3	6
Research Methodology and Scientific Writing	3	6
Principles of GIS	2	4
Practice in Research Project Ⅰ	6	12
Total:	**16**	**32**
4th Semester(WHU)		
Generalized Adjustment	2	4
Digital Terrain Surface Simulation & its Methods	2	4
Hyperspectral Remote Sensing	2	4
Spatial Statistics &Analysis	2	4
Practice in Research Project Ⅱ	6	12
Total:	**14**	**28**

Application

Required documents for TUM students who would like to participate in the ESPACE Double Degree Program with Wuhan University are:

- Letter of intent
- Curriculum Vitae
- Copy of TUM grading list from 1st semester (if available)
- Copy of B.Sc. degree certificate and transcripts of records
- Copy of English proficiency

Application deadline: July 15

General information on both universities

Academic year:

The academic year at the WHU begins in the summer term:
Summer term: September - January
Winter term: February - July
Vacation between the terms starts in July and lasts two months.

Study year at the TUM starts in the winter term:
Winter term (lectures and exams): mid-October – beginning of March
Summer term (lectures and exams): mid-April – mid-August

Credits:

WHU: To obtain a Master's degree, the students are required to earn 34 credits in the Wuhan University Credit System (of which at least 28 are for degree courses and 6 are for elective courses). Further, a written thesis must be submitted and be defended in a colloquium. At the WHU, there is no fixed amount of credits that needs to be obtained for each semester. If the students select more courses, they can earn more credits. One credit in the Wuhan University Credits System corresponds to 18 hours of classes.

TUM: see Sect. III

The scaling factor is 0.37 for the conversion of Wuhan University Credits System into the ECTS, that is:

1 WHU credit = 0.37 ECTS credits
1 ECTS credit = 2.7 WHU credits

Grading scale:
TUM grades are awarded on a scale from 1.0 (best) to 5.0 (worst). Grades for individual exams are given in the increments 1.0, 1.3, 1.7, 2.0… 4.7, 5.0. The grading scale is expressed below.
WHU has two grading systems. Most courses are graded A, B,…, F. A few courses are graded P(Pass) or F(Failure).

WHU	TUM	Definition
A (90-100)	1.0, 1.3	Very Good
B (80-89)	1.7, 2.0, 2.3	Good
C (70-79)	2.7, 3.0, 3.3	Satisfactory
D (60-69)	3.7, 4.0	Sufficient
F (0-59)	4.3, 4.7, 5.0	Fail

Practical information for outgoings

Wuhan University provides information for foreign students coming to Wuhan on the internet. Here various types of information on registration, Chinese language courses, a study and campus guide, etc. can be found:

http://fses.whu.edu.cn/en/

Field reports written by TUM students who have already studied in China as exchange students contain useful information (in German only).

http://moveonline.zv.tum.de/move/moveonline/exchanges/search.php

Housing

Foreign student buildings in Maple Garden are student halls where foreign students can live.

Facilities: Central Air-Conditioner, telephone, flush toilet and shower / bath

Fees:

- Building No. 1: Flat with 4 bedrooms (4 students share one flat): 900 RMB/month/person. (1 EUR= 7.87 RMB, 14.08.2012)
- Building No. 2: Single room: 1200 RMB/month/person.
- Building No. 4 and 5: Flat with 2 bedrooms (2 students share one flat): 1000 RMB/month/ person.

NOTES：Students should purchase bedding by themselves. They can also purchase it at the Life Administration Office, College of Foreign Students Education (260 RMB for each set).

Student Visa

Information on the visa application such as required documents and fees can be found at:

http://www.china-botschaft.de/det/lsfw/t514074.htm (in German only)

Health insurance

Students are recommended to contact their insurance company in Germany for a sufficient insurance cover for studies abroad.

Links for scholarships

The TUM International Office has listed some scholarships for students going to China:

http://portal.mytum.de/studium/ausland/rundumdiewelt/tumexchange/laotse/index_html/#voraussetzungen

Students going to China to study can apply for scholarships provided by the Chinese Government (information available only in German): http://www.baychina.org/wordpress/

Contact Information

WHU:

Prof. Qing Zhu

State Key Lab of Information Engineering in Surveying, Mapping, and Remote Sensing

zhug66@263.net or zhuging@lmars.whu.edu.cn

Wuhan International Office:

exchange@whu.edu.cn

Appendix

Short Introduction to the TUM

In 1833 a "Technical Institute" was established which was affiliated with the University of Munich. In 1868, King Ludwig II founded an independent Polytechnic Institute, the nucleus of today's Technical University. Having moved into new buildings in the Arcisstraße, the Polytechnic Institute began functioning in its first year with 450 students across 5 departments, 24 professors and 21 instructors. This technical-scientific "institute" (since 1970 the "Technische Universität München" - TUM) is thus among the oldest engineering colleges and remains the only institution of its kind in Bavaria.

In 1930, the much older Weihenstephan "College of Agriculture and Brewing" (which celebrated its 300th Anniversary in 1997) was annexed by the Munich Polytechnic Institute. Following World War II, 85% of the Polytechnic Institute's buildings (housing 80 academic chairs) were unusable, some of them having been completely destroyed. In 1957 a research reactor ("Atom Egg") was built in Garching, and by 1960 re-construction of the Polytechnic Institute's facilities was nearly complete. In the years following completion of the reactor, the Departments of Physics and Chemistry moved out to the research area in Garching, but the planned move of the entire TUM to Garching was never realized. Following a resolution in the Bavarian State Parliament, a Department of Medicine was founded in September, 1967. In 1968, 100 years after its founding, the Technical Institute had Departments of Mathematics, Physics, Chemistry, Medicine, and General Sciences, a total of 168 academic chairs and institutes, around 8,400 students, and 5,700 staff and faculty members employed in offices, teaching, research, and administration.

Presently (2013) the TUM has over 9,704 employees. Nearly 32,000 students, almost 18% of whom are international, are enrolled in its 13 academic departments.

TUM academic departments are divided among three sites in the greater Munich area with the main campus situated in the center of Munich. The faculties of Architecture, Medicine, Electrical Engineering and Information Technology, Civil, Geo and Environmental Engineering, Economics and Social Sciences are located on the main campus. A second large TUM complex is located in Garching, about 10 km north of Munich. Here the departments of Physics, Chemistry, Information Studies, Mathematics, and Mechanical Engineering are headquartered around the Garching research reactor. Over the years, numerous research institutes, including the Max-Planck Society, the Bavarian Academy of Science, and the Ludwig-Maximilians University of Munich, have joined TUM departments in Garching. TUM's third campus is 35 kilometers away in Weihenstephan (near Freising) and is home to the Departments of Biology, Science of Agriculture and Horticulture, Forestry and Resource Management, Brewing and Food Technology, Nutrition, Landscape Planning and Landscape Architecture. There are many institutions across the city of Munich and in the surrounding area which also belong to the TUM. These include the "Rechts der Isar" hospital for training medical students and the Central University Athletic Complex.

Useful TUM Office Contact Information

In this section you will find contact information for some relevant offices or centers at the TUM.

University Library

Address: Arcisstraße 21, 80333 München

Location: TUM Central Campus, Main Building, 1st floor

Open during semester: Mon-Fri.: 8 a.m.-12 p.m.; Sat, Sun, and Public Holidays: 9 a.m.-10 p.m.

Tel.: 089-189-659-220 (Mon-Fri.: 8 a.m. – 8 p.m.)

E-Mail: information@ub.tum.de

Web: http://www.ub.tum.de/en

Student Service Center

Address: Arcisstraße 21, 80333 München

Location: Service Desk, TUM Central Campus, Main Building, Ground floor, Room 0140

Open during semester: Monday-Thursday, 9-12 a.m. and 1-4 p. m. and Friday, 9-12 a.m.

E-Mail: study@tum.de

Web: http://www.tum.de/en/studies/student-service-center/

Prüfungsamt (Examination Office)

Address: Student Service Center Examination Office, Arcisstraße 21, 80333 München

Location: TUM Central Campus, Main Building, Ground floor, Room 0165

Open during semester: Mon., Tues., Thurs., Fri.: 8:30-12; Wednesdays CLOSED

Tel.: 089 289 22241

Web: http://www.tum.de/en/studies/completing-your-studies/final-documents-graduating-documents/

Immatrikulationsamt (Admission and Enrollment Office)

Address: Arcisstraße 21, 80333 München

Location: TUM Central Campus, Main Building, Ground floor, Room 0140

Open during semester: Mon-Thurs: 9:00-12:00 and 13:00-16:00; Fridays 9:00-12:00

Tel.: 089 289-22245

Email: study@tum.de

Web: https://campus.tum.de/tumonline/wborggruppen.gruppen?pOrgNr=14432

TUM Student Advising

Address: Arcisstraße 21, 80333 München

Location: TUM Central Campus, Main Building, Ground floor, room 0140

Open during semester: Mon.-Fri.: 9:00-12:00; Mon.-Thurs.: 13:00-16:00

Tel.: 089 289 22245

Email: study@tum.de

Web: http://www.tum.de/en/studies/advising/student-advising/

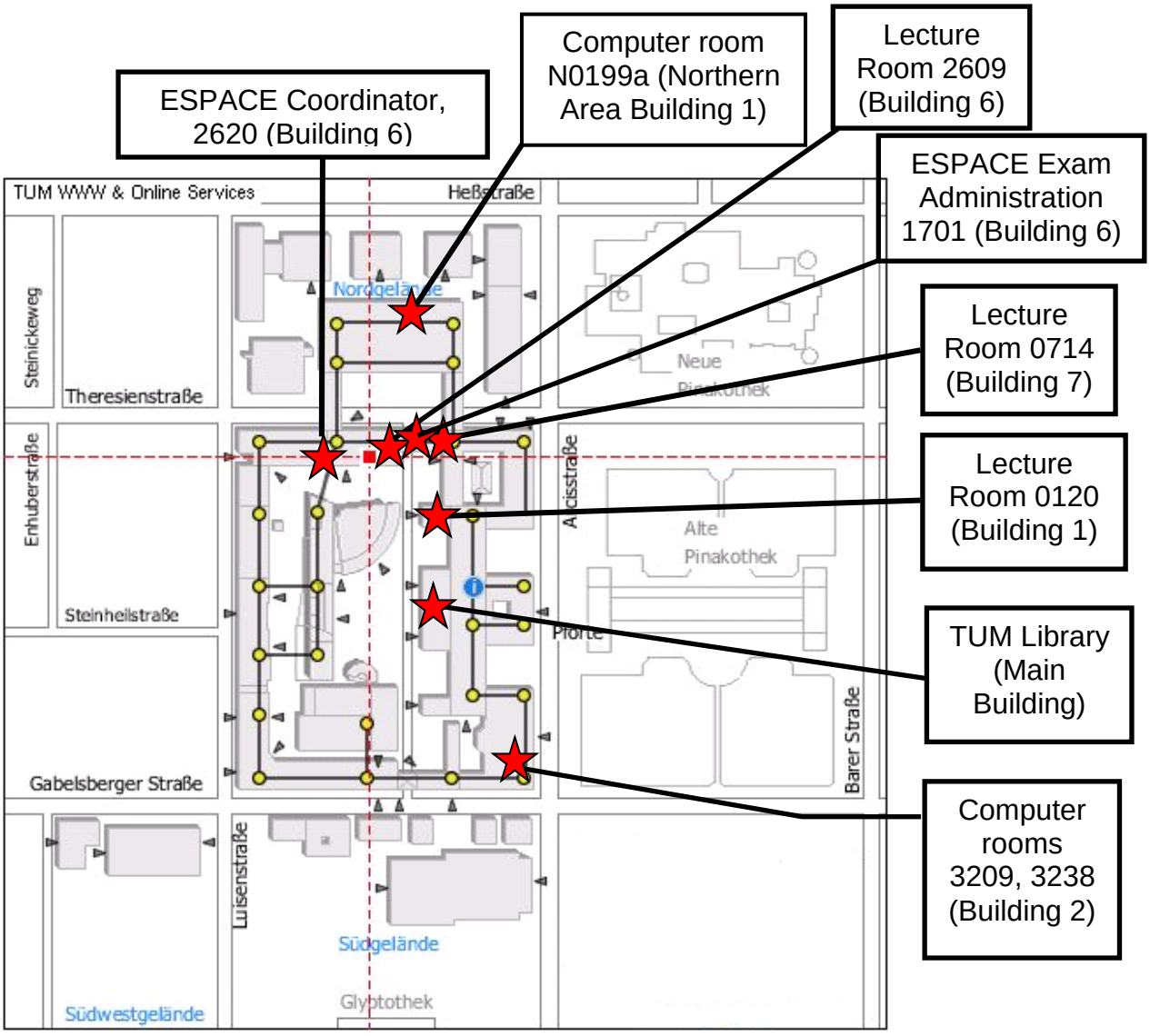
ESPACE Lecturer Contact Information

Name	Email	Lectures in
Adam, Nico, Dr.	Nico.Adam@dlr.de	Seminar Remote Sensing
Bamler, Richard, Prof. Dr.	richard.bamler@dlr.de	Signal Processing and Microwave Remote Sensing; Estimation Theory; Seminar Remote Sensing
Bedrich, Stefan, Dr.	stefan.bedrich@kayser-threde.com	Advanced Aspects of Navigation Technology
Bosch, Wolfgang, Dr.	bosch@dgfi.badw.de	Atmosphere and Ocean
Diedrich, Erhard, Dr.	Erhard.Diedrich@dlr.de	Ground and User Segment
Doicu, Adrian, Dr.	adrian.doicu@dlr.de	Projects in Earth Oriented Space Science and Technology, Nonlinear Optimization Methods
Eineder, Michael, Prof. Dr.	michael.eineder@dlr.de	Signal Processing and Microwave Remote Sensing; Remote Sensing Adv. Methods
Gruber, Thomas, Dr.	thomas.gruber@bv.tum.de	Applied Computer Science; Projects in Earth Oriented Space Science and Technology
Günther, Christoph, Prof. Dr.	christoph.guenther@dlr.de	Satellite Navigation and Advanced Orbit Mechanics
Harder, Jan, Dipl.-Ing.	j.harder@tum.de	Spacecraft Technology
Henkel, Patrick, Dr.-Ing.	patrick.henkel@tum.de	Satellite Navigation and Advanced Orbit Mechanics
Hoegner, Ludwig, Dipl.-Inf.	ludwig.hoegner@tum.de	Intro. to Photogrammetry, RS and Image Processing
Hugentobler, Urs, Univ.-Prof. Dr.phil.nat.	urs.hugentobler@bv.tum.de	Orbit Mechanics, Satellite Navigation and Advanced Orbit Mechanics; Precise GNSS;
Kiemle, Christoph, Dr.	Christoph.Kiemle@dlr.de	Atmosphere and Ocean
Körner, Marco, Dr.	marco.koerner@tum.de	Estimation theory
Iwaszczuk, Dorota, Dr.-Ing.	Dorota.Iwaszczuk@tum.de	Satellite Mission Design Project; EO Toolboxes

Name	Email	Lectures in
Meng, Liqiu, Prof. Dr.	meng@bv.tum.de	Geoinformation
Montenbruck, Oliver, Dr.	oliver.montenbruck@dlr.de	Navigation Labs; Advanced Aspects of Navigation Technology

Murphy, Christian	christian.murphy@bv.tu-muenchen.de	Geo-Information
Neidhardt, Alexander, Dr.rer.nat.	neidhardt@fs.wettzell.de	Applied Computer Science
Pail, Roland, Univ.-Prof.Dr.techn.Mag.rer.nat.	pail@bv.tum.de	Intro. to Earth System Science; Seminar Earth System Dynamics; Gravity and Magnetic Field from Space
Passaro, Marcello, Dr.	marcello.passaro@tum.de	Atmosphere and Ocean
Rodriguez Solano, Carlos Javier, M.Sc.	rodriguez@bv.tum.de	Orbit Mechanics; Satellite Navigation and Advanced Orbit Mechanics
Rott, Martin, Dr.	m.rott@lrt.mw.tum.de	Spacecraft Technology
Purschke , Ralf, Dipl.-Ing.	r.purschke@lrt.mw.tum.de	Seminar Spacecraft Technology
Schmidt, Michael, Prof. Dr.	schmidt@dgfi.badw.de	Numerical Modeling
Schreiber, Karl Ulrich, Prof. Dr.	schreiber@fs.wettzell.de	Seminars
Schunerth, Bernhard, Dr.	bernhard@geophysik.uni-muenchen.de	Introduction to Earth System Science
Seitz, Florian, Prof. Dr.	seitz@bv.tum.de	Earth System Dynamics; Projects in Earth Oriented Space Science and Technology
Sicramaz Ayaz, Ayse, Dr.	ayse.sicramaz@unibw.de	Receiver Technology
Stilla, Uwe, Prof. Dr.-Ing.	Uwe.Stilla@bv.tu-muenchen.de	Photogrammetry; Intro. to Photogrammetry, RS and Image Processing
Strunz, Günther, Prof. Dr.	guenter.strunz@dlr.de	Applied Earth Observation and Mission Engineering
Walter, Ulrich, Prof. Dr.	u.walter@lrt.mw.tum.de	Spacecraft Technology
Dr.-Ing. Xiaoxiang Zhu	xiaoxiang.zhu@bv.tum.de	Signal Processing and Microwave Remote Sensing; Seminar Remote Sensing

Map of the main campus with relevant rooms



Room numbers

The TUM room numbers are coded as follows:

- First digit corresponds to the floor
- Second digit corresponds to the building
- Third and fourth digit correspond to the actual room number

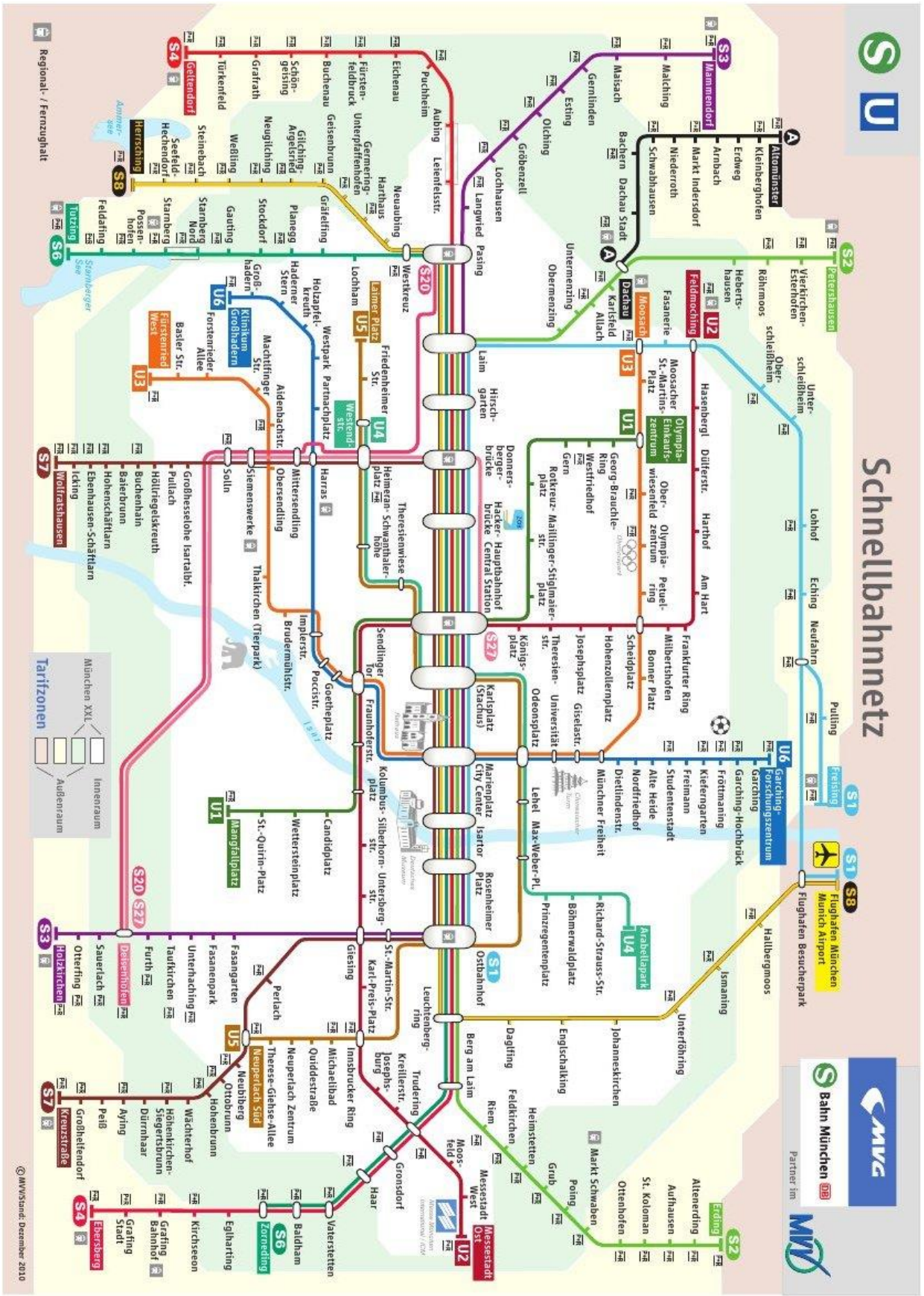
The inner city campus is divided into three areas: the central one, the northern one (north of Theresienstrasse) and the southern one (south of Gabelsbergerstrasse). All room numbers in the southern area have the prefix “S” and the northern part an “N”. Rooms in the central area are not preceded by a letter.

Examples:

Room 2609 Central area, 2nd floor, Building 6, Room 09

Room N 1170 Northern area, 1st floor, Building 1, Room 70

Map of public subway system (MVV Netzplan) *



*Trains do not run 24 hours a day 7 days a week—make sure to check at the U or S-Bahn station information desks/boards for closing times!