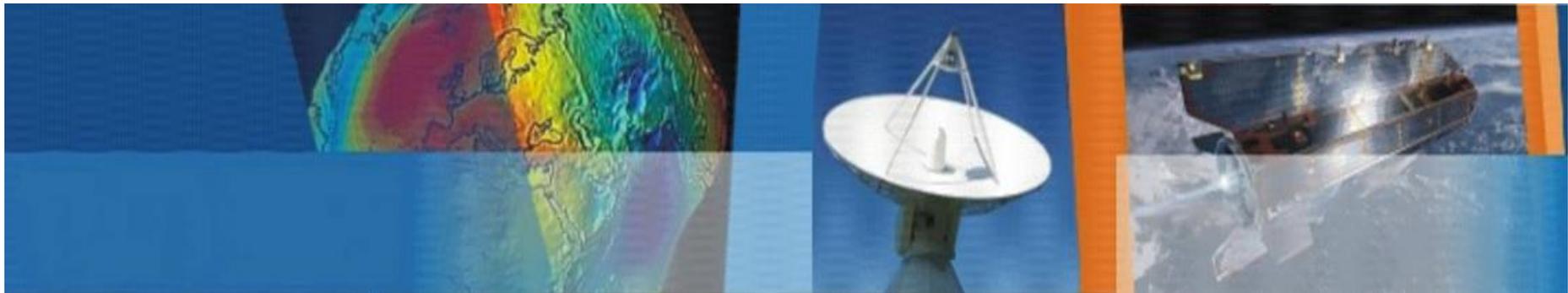


ESPACE – Earth Oriented Space Science and Technology

International Master's Program

Mariia Usoltseva (espace.iapg@ed.tum.de)
ESPACE Degree Program Coordinator





Spacecraft Engineering

Studies: Aerospace Engineering

Satellite Data Users

Studies: Geodesy, Geophysics, Oceanography, Meteorology

Problem: Classical university programs cover parts of this spectrum in different disciplines → segregation of engineering and science

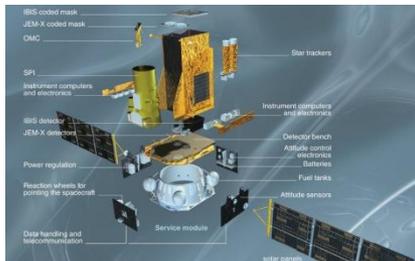
- Master's program ESPACE combines spacecraft engineering with satellite applications in one interdisciplinary program
- This combination makes ESPACE a unique study program in Europe

○ International Master's program (2 years):

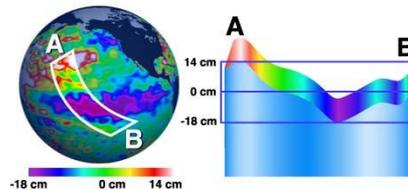
- Graduates can be best described as **Satellite Application Engineers**
- All lectures are in English
- International environment with students from all over the world
- Students can specialize in one of three satellite applications:
 - Earth System Science
 - Remote Sensing
 - Navigation

○ Target Group:

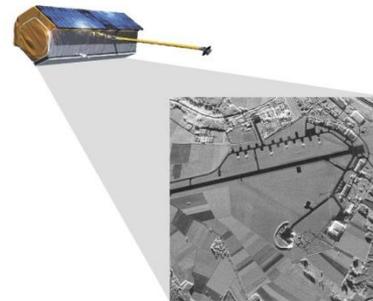
- Students from engineering programs such as aerospace, mechanical, electrical, communication, environmental, or science programs such as geodesy, as well as geophysics, physics or mathematics



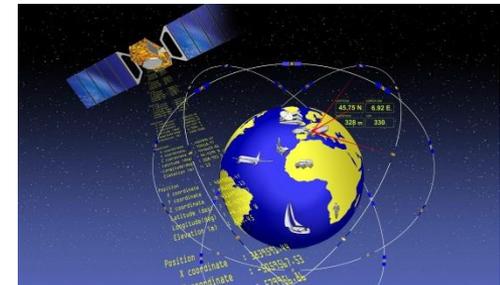
Spacecraft Engineering



Earth System Science



Remote Sensing

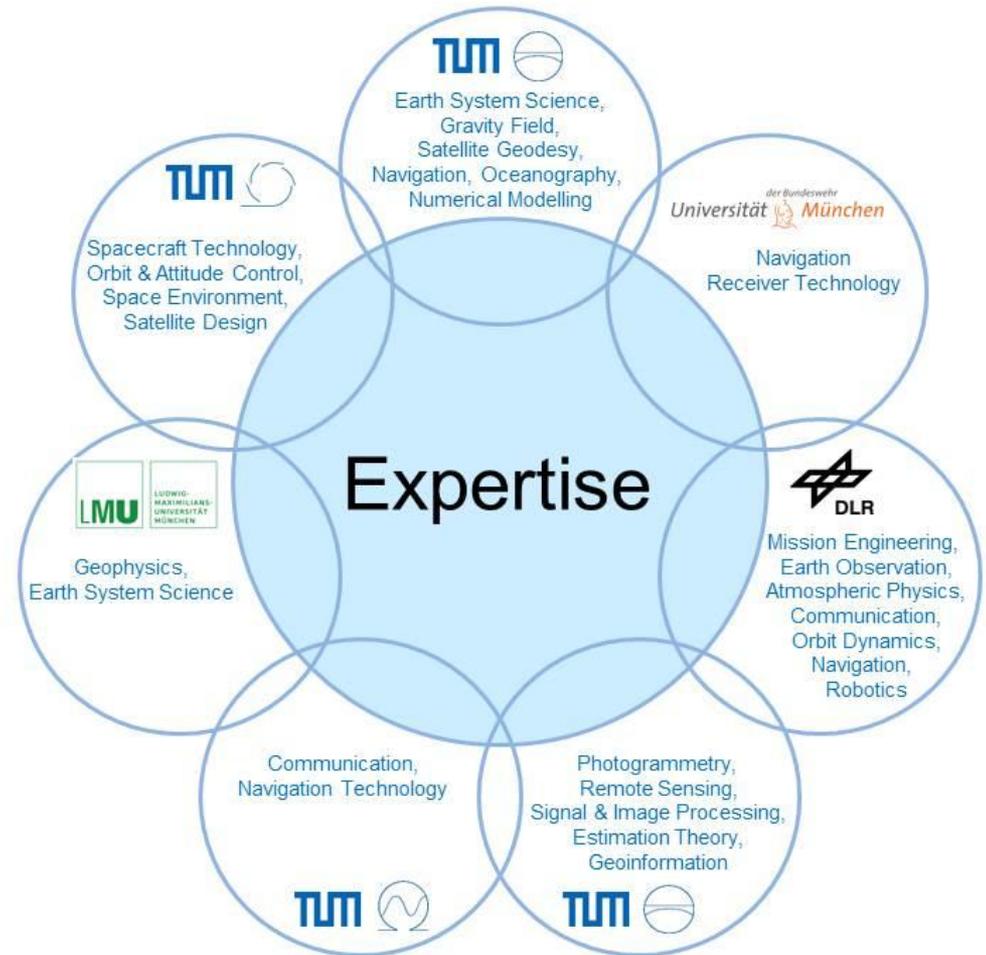


Navigation

Munich has a unique concentration of know-how related to Space Science and Technology!

ESPACE is coordinated at TUM with teaching staff from:

- **Universities:** TUM, Ludwig-Maximilian-Universität (LMU), University of Federal Armed Forces (Universität der Bundeswehr)
- **Research Institution:** German Aerospace Center (DLR), German Geodetic Reserach Institute (TUM-DGFI)



Curriculum



1 st Semester	2 nd Semester	3 rd Semester	4 th Semester
Introduction to Satellite Navigation and Orbit Mechanics 5 CP	Project Seminar in Earth Oriented Space Science and Technology 5 CP	Specialization (see separate figure) 15 CP	Master's Thesis Master's Colloquium 30 CP
Numerical Modeling and Signal Processing 5 CP	Advanced Numerical Modeling and Signal Processing 5 CP		
Estimation Theory: Mathematical and Statistical Basics 5 CP	Satellite Navigation and Advanced Orbit Mechanics 5 CP		
Applied Computer Science 5 CP	Machine Learning for Earth Observation 5 CP	Satellite Mission Design Project 5 CP	
Introduction to Spacecraft Technology 5 CP	Advanced Spacecraft Technology 5 CP	Interdisciplinary Electives 10 CP	
Introduction to Earth System Science 5 CP	Ground and Space Mission Elements 5 CP		
Introduction to Photogrammetry, Remote Sensing and Digital Image Processing 5 CP	Advanced Remote Sensing 5 CP		
	Earth System Modelling 5 CP		
	Free Electives 5 CP		
Required 20 CP	Required -	Required 5 CP	Required 30 CP
Required Electives 10 CP (2 of 3)	Required Electives 25 CP (5 of 8)	Required Electives 15 CP	Required Electives -
Electives -	Electives 5 CP	Electives 10 CP	Electives -
30 CP	30 CP	30 CP	30 CP
6 Exams	6 Exams	6 Exams	1 Exam

Specialization in the 3. semester

3 rd Semester - Themes of Specialization		
Earth System Science from Space	Remote Sensing	Navigation
Atmosphere and Ocean 5 CP	Geoinformation 5 CP	Precise GNSS and Inertial Navigation 5 CP
<u>Geokinematics</u> and Continental Hydrology 5 CP	Photogrammetry – Selected Chapters 5 CP	Advanced Aspects of Navigation Technology 5 CP
or Advanced Earth System Modeling and Continental Hydrology 5 CP		
Space-based Gravity and Magnetic Field Monitoring 5 CP	Remote Sensing 5 CP	Navigation Labs 5 CP
15 CP	15 CP	15 CP
3 Exams	3 Exams	3 Exams

Core themes and modules

Core Theme & Modules	Type	Semester
Mathematical Foundations		
Numerical Modelling and Signal Processing	required	1
Estimation Theory and Statistical Basics	required	1
Advanced Numerical Modeling and Signal Processing	required elective	2
Aerospace		
Introduction to Spacecraft Technology	required elective	1
Advanced Spacecraft Technology	required elective	2
Ground and Space Mission Elements	required elective	2
Satellite Mission Design Project	required	3
Orbits, Navigation & Computer Science		
Introduction to Satellite Navigation and Orbit Mechanics	required	1
Applied Computer Science	required	1
Satellite Navigation and Advanced Orbit Mechanics	required elective	2
Specialization	required elective	3
Earth System Science from Space		
Introduction to Earth System Science	required elective	1
Project Seminar in ESPACE	required elective	2
Earth System Modelling	required elective	2
Specialization	required elective	3
Photogrammetry & Remote Sensing		
Introduction to Photogrammetry, Remote Sensing & Digital Image Processing	required elective	1
Machine Learning for Earth Observation	required elective	2
Advanced Remote Sensing	required elective	2
Specialization	required elective	3

Career opportunities

- Work as a satellite application engineer in national space agencies, space industry, industries using satellite data, research institutions or universities
- Around 50% of our graduates stay in academia to pursue a PhD

Example jobs of our graduates:

- Satellite Navigation Engineer
 - Geospatial Data Engineer
 - Remote Sensing Data Scientist
 - Satellite System Engineer
 - Research positions connected with satellite data processing/application
- Career path heavily depends on personal interests and a combination of skills from bachelor's and master's studies



Excursion to Geodetic Observatory Wettzell Christmas party with students & lecturers

- Orientation Week for first semester students
→ week before start of the lecture period in winter semester
- Buddy Meeting with previous ESPACE batches
- ...

- Two Master's degrees:
 - one from TUM
 - one from Wuhan University (WHU)
- Duration: 3 years (one more year than regular ESPACE Master's program)
- First year at TUM, second year at WHU, third year at TUM
- Funding possibilities

Decision on participation
within your first semester!



One year study visit at one of the leading technical universities in Europe

Decision on participation
within your first semester!

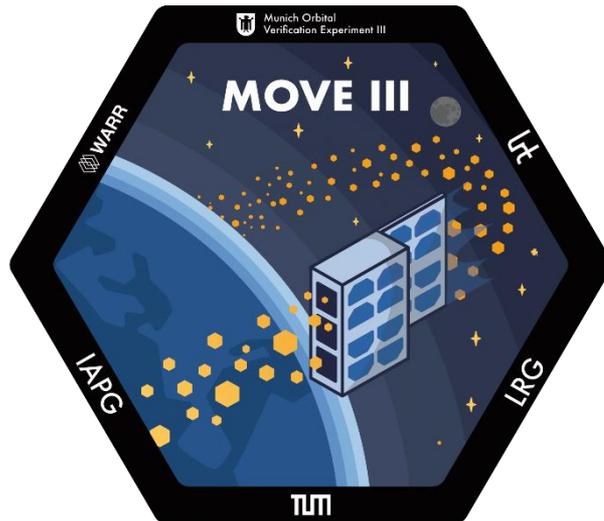
- Duration: 2 years (as regular Master's program in ESPACE)
- First year – at TUM
- Exchange in 2nd year of Master's Program to DTU
- funding via Erasmus+
- Master of Science (TUM) + transcript from DTU



1 st semester, TUM – ESPACE	2 nd semester, TUM – ESPACE
Regular study program (30 ECTS)	Regular study program (30 ECTS)
3 rd semester, Fall at DTU	4 th semester, Spring at DTU
Compulsory: 15 ECTS Required electives: At least 10 ECTS Electives: Up to 5 ECTS	Co-supervised Master's Thesis (30 ECTS)

MOVE-III

- Development of 6U CubeSat for detection and identification of sub-millimeter space debris particles
- <https://warr.de/en/projects/move/move-iii/>



Astronomy Club

- Observatory at TUM Main Campus
- <https://www.asg.ed.tum.de/fesg/astronomy-club/>



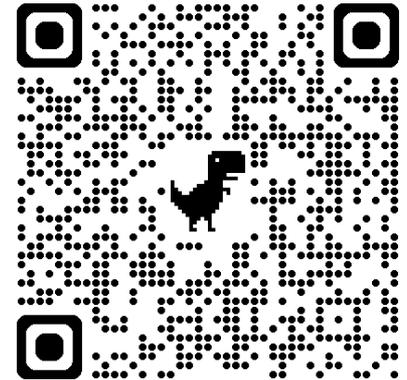
Application period: January 1 to May 31

Aptitude assessment for all students

○ Documents:

- Statement of purpose (motivation letter)
- short self-written essay (500 – 700 words)
- Transcript of records (at least 140 credits) → competencies in mathematics, physics and computer science
- English language certificate
- CV

- Tuition Fees from winter semester 2024/25: 6000 € per semester for ESPACE
<https://www.tum.de/en/studies/fees/tuition>

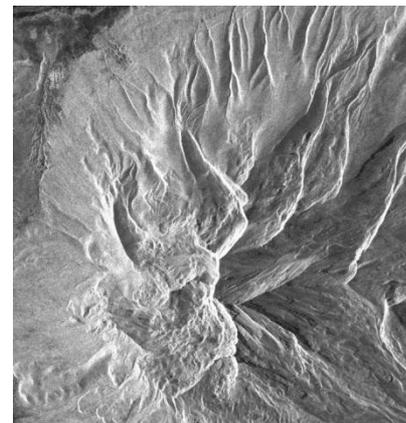
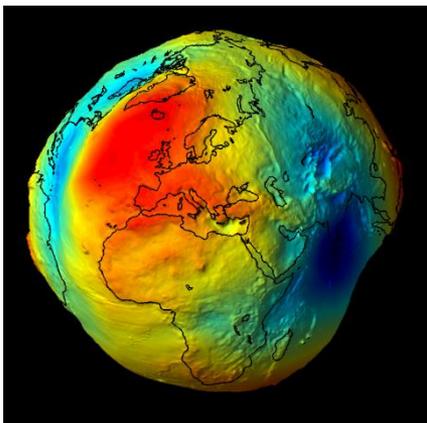
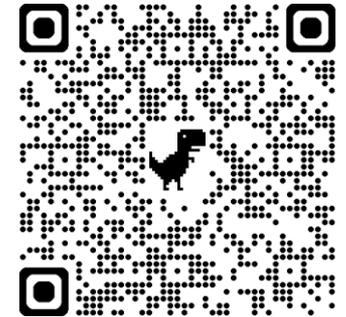


ESPACE Website:

<https://collab.dvb.bayern/display/TUMedschooloffice/M.Sc.+ESPACE+-+Earth+Oriented+Space+Science+and+Technology>

Questions?

info@espace-tum.de



Thank you very much for your attention!