

Space Technologies



ECTS credits
8 credits



Semester
Spring

In brief

> **Course language:** French

Presentation

Learning objectives

The design, production, validation and operation of space instruments, whether for Earth Observation or the Sciences of the Universe, require the implementation of very specific technologies and techniques at all stages of a space project. These techniques allow the realization of instruments that are not only adapted to severe environments but that also meet the resulting reliability requirements.

These specific techniques, as well as the associated advanced technologies, will be presented by taking as an example the design and the realization of an observation instrument for astrophysics, while presenting, whenever possible, the declination of these for Earth observation missions or for other industrial fields.

Description of the programme

After a presentation of the context and the bases of the preparation of a space mission, in particular in terms of Phasing, Maturity Level (TRL) and Quality as well as the declination of the specific constraints to space on the associated techniques and technologies, the program developed will be as follows:

System engineering: presentation of the important aspects in the analysis and design of a space opto-mechanical system, from the establishment of specifications to the establishment of an error budget and the estimation of performances.

Spectral analysis techniques: This module aims to introduce the various spectral analysis techniques used in astrophysics, but some of which are also used in other fields, including industry.

Wavefront control: presentation of the different techniques to control and maintain the quality of the wavefront of a telescope or a space instrument (active/space adaptive optics).

Space opto-mechanics: design of a space opto-mechanical system, from its definition, through its thermomechanical modeling and the insertion of actuation and measurement systems, to the preparation of functional tests.

Assembly, integration, tests/validation: This module will address the qualification phase of a space instrument or system, including the various environmental tests (vacuum, thermal, vibration) performed during the integration and validation of the system.

Space data management (new in 2022, description to come)

Generic central skills and knowledge targeted in the discipline

Theme 2: Complex Systems and Complexity

Space instruments are by nature extremely complex by their technical nature and by their design, integration and validation. These courses will allow students to address this complexity.

Theme 3: Programs

Space missions are designed within the framework of national or international programs. These lessons will allow to approach the scientific and technical aspects.

How knowledge is tested

Continuous assessment

Bibliography

Course notes and documents provided by the teaching staff.

Teaching team

- * Astronomers and engineers from the Marseille Astrophysics Laboratory
- * Industrial and ONERA speakers

Total des heures

0h

Useful info

Name responsible for EU

Lead Instructor

Laurent Gallais-During

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