Space Instrumentation

ELEC-E4220 (5 cr)

Teachers: Anne Lähteenmäki

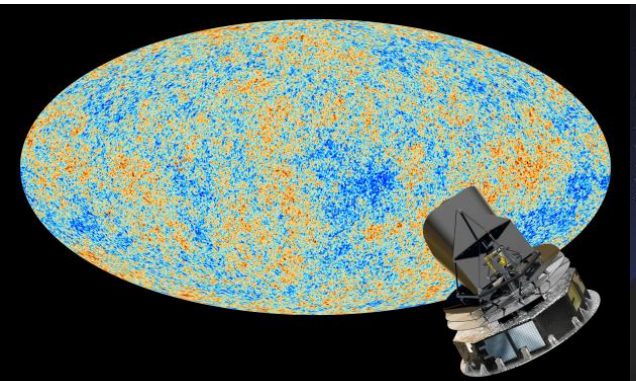
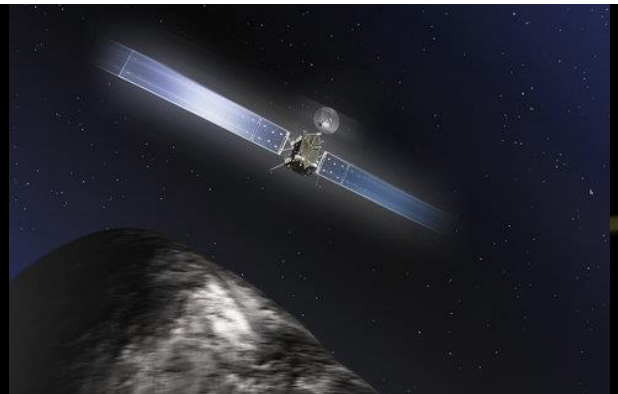
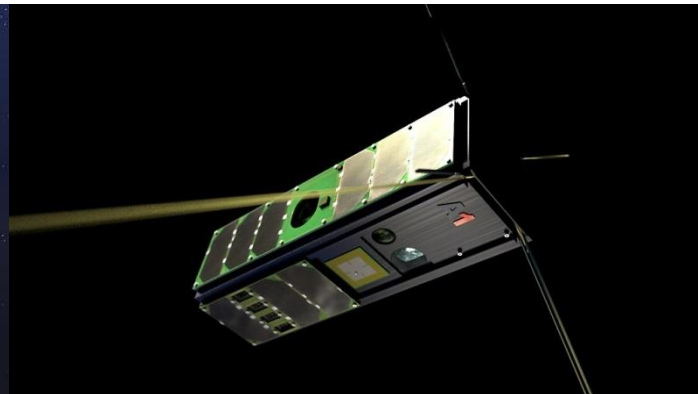
Esa Kallio

Guests

Today

- Course introduction and practicalities (AL)
- Why go to space?
  - Astronomy: AL
  - Solar system & Space physics: EK

ESA

Space science and technology courses

- ELEC-E4210 Introduction to space
- ELEC-E4220 Space instrumentation
- ELEC-E4230 Microwave Earth Observation instrumentation
- ELEC-E4240 Satellite systems
- ELEC-E4520 Space physics
- ELEC-E4530 Radio astronomy
- ELEC-E4540 Space climate
- ELEC-E4920 Space technology project (5 – 10 cr)
- ELEC-E4930 Special assignments (5 – 10 cr)

Course content

- Observational techniques in astronomy and space physics.
- Scientific payloads of satellites and probes.
- Effect of space environment on instrumentation.
- Life cycle of a space mission: researcher's view.
- Examples of science missions.
- Design your own mission.

Learning outcomes

- After this course the student knows why and how information about astronomical and solar system phenomena is collected.
- She/he can describe the physical principles on which the scientific instruments onboard satellites and probes are based.
- The student is able to differentiate between various types of instruments and observing techniques and what they are used for, and evaluate which kind of systems are suitable for measuring certain astronomical and solar system phenomena.
- She/he identifies what kinds of effects space environment has on instrumentation and observations.
- The student is able to review the state-of-the-art space instrumentation and its immediate possibilities and challenges.
- She/he can explain the life cycle of a space mission from a researcher's point of view (from long-term planning, such as ESA's Cosmic Vision, to implementation and operation of a space mission, all the way to analysis of the scientific data), and give examples of scientific space missions.

Workload

Course structure

Follow the teaching session listings in section Course schedule in MyCourses. All you need to know is in MyCourses.

We will have:

- Live teaching sessions via Zoom.
- Possible pre-recorded materials and other self-study materials.
- Assignments, quizzes…

Course structure

- Contact sessions on Tuesdays 14-16 and Thursdays 12-14 via Zoom.
- Two parts: solar system & astronomical space instrumentation
- Lectures, assignments, project work & report
  - No exam
- All you need to know is in MyCourses.

How to participate in live teaching sessions

- Zoom room for the course can be found in MyCourses in the Course schedule section.
- Always use this link on this course, for all teaching sessions.
- We start quarter pass the hour, that is 12.15 or 14.15.
- It is difficult for the teacher to follow chat during lectures so please be patient with possible questions.

How to work with self-study materials

- Follow the instructions given for the teaching session. The materials are given in the order you should study them.
- Self-study materials typically include pre-recorded lectures, links to reading materials, videos, simulations and such, quizzes, assignments as usual…
- In this case there is usually no live teaching session: always check the course schedule!

Is it live or not? (Example from another course)

Yes

7.9.2020 Course introduction & information

Time: Monday 7.9.2020 at 10 -12

Teaching method: Live zoom lecture.

Assignments: No assignments this week yet.

Teachers: Anne Lähteenmäki and Esa Kallio

No

2.11.2020 Theory session: Emission mechanisms 1

Time:

Teaching method: lecture videos, textbook

Assignments: *Coming soon*

Teachers: Joni Tammi

Course schedule, Part 1

Date	Topic
Tue 8.9.	Course introduction.
Thu 10.9.	**No Teaching**
Tue 15.9.	Solar system instruments: Langmuir probe, RPA, radars 1 and ionosonde.
Thu 17.9.	Introduction to this week's assignment.
Tue 22.9.	Ground based instruments: radars 2, radio wave and plasma wave instruments.
Thu 24.9.	Introduction to this week's assignment.
Tue 29.9.	Remote sensing instruments.
Thu 1.10.	Introduction to this week's assignment.
Tue 6.10.	Magnetic field measurements.
Thu 8.10.	Introduction to this week's assignment.
Tue 13.10.	High energy particle instruments, miniaturized cubesat instruments.
Thu 15.10.	Introduction to the final assignment of Part I.
Tue 20.10.	**No teaching** (exam week).
Thu 22.10.	**No teaching** (exam week).

Course schedule, Part 2

Tue 27.10. Astronomical space missions: an overview.

Thu 29.10. A look into the future: astronomical space missions in the next few decades.

Tue 3.11. Project work kick-off.

Thu 5.11. Project work help & discussion.

Tue 10.11. Lifecycle of a space mission. Case study: the Planck satellite.

Thu 12.11. Project work help & discussion.

Tue 17.11. High-energy space missions I. X-rays, XMM-Newton satellite, Chandra etc.

Thu 19.11. Project work help & discussion.

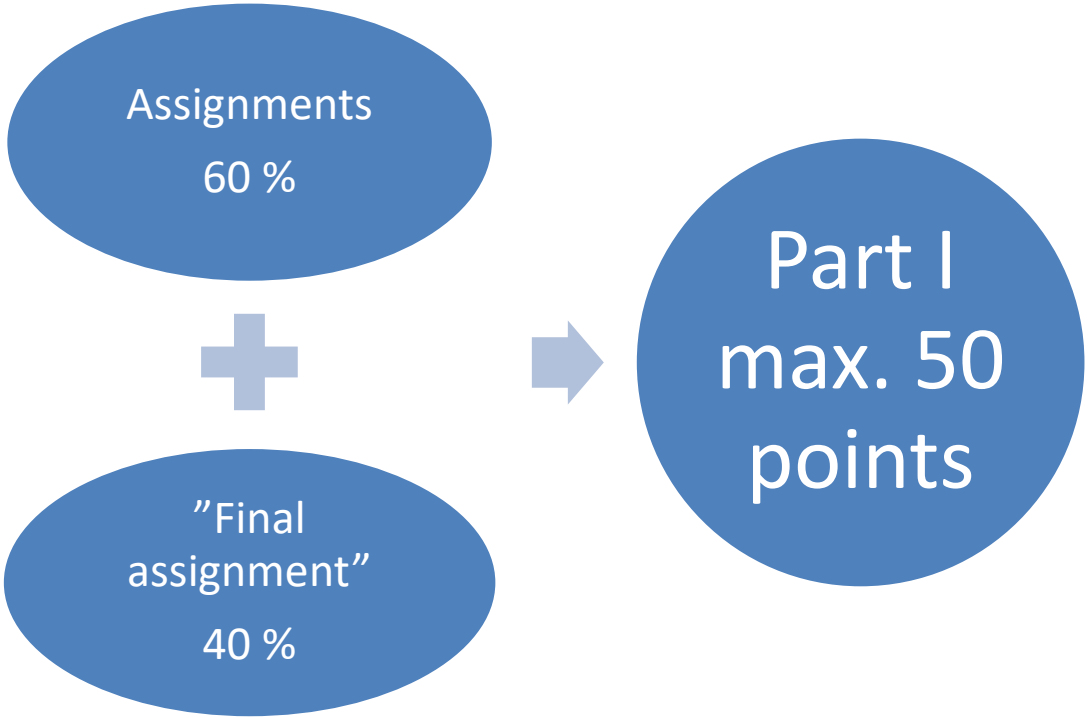
Tue 24.11. High-energy space missions II. Gamma-rays, Fermi satellite.

Thu 26.11. Project work help & discussion

Tue 1.12. Peer-assessment: what does it mean. A (very) short introduction to UV astronomy. How do I get observing time with a satellite?

Thu 3.12. **No teaching.** Use this time for working on your project reports.

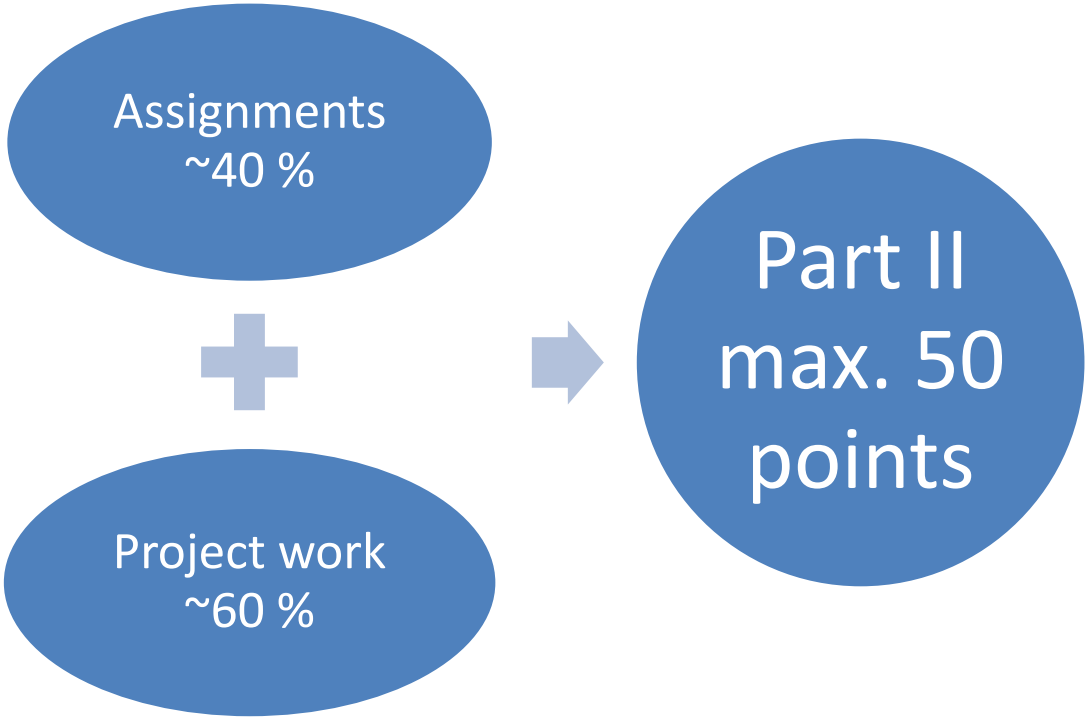
Evaluation and grading: Part I



Part I requirements

- The maximum number of points is 50:
  - Assignments: 5 x 6 points = 30 points in total.
  - Final assignment: 20 points.
- Approx. 50% are required for passing the course.
- Details posted in MyCourses (”Evaluation and grading”).

Evaluation and grading: Part II



Part II requirements

Student contribution	Points	Comments
Assignments	3 x 5 = 15 in total	3 assignments, maximum of 5 points each.
Project plan	10	
Project report	20	
Peer-assessment	5	Points are given for the quality of the assessment.

- The maximum number of points is 50. Approx. 50% are required for passing the course.
- Will be explained in detail when Part II starts.
- In the meantime, details posted in MyCourses (”Evaluation and grading”).

To pass the course you need to do …

- Part I:
  - Assignments
  - Final assignment
- Part II:
  - Assignments
  - Project work (plan and report)
  - Peer-assessment

The final course grade is based on the total number of points in Parts I and II: 100 points.

We need your feedback!

- During and after the course:
  - E-mail
  - MyCourses
  - Talk to us
  - Take the course survey
- Your chance to make this a good course!