

Space Instrumentation ELEC-E4220 (5 cr)

5.11.2019

- Part II project work kick-off.

ESA



Design your own astronomical space mission

Tue 22.10. **No teaching** (exam week).

Thu 24.10. **No teaching** (exam week).

Tue 29.10. Astronomical space missions: an overview.

Thu 31.10. A look into the future: astronomical space missions in the next few decades.

Tue 5.11. Project work kick-off.

Thu 7.11. Project work.

Tue 12.11. Lifecycle of a space mission. Case study: the Planck satellite.

Thu 14.11. Project work. A short introduction: how do I get observing time with a satellite?

Tue 19.11. High-energy space missions I. X-rays, XMM-Newton satellite, Chandra etc.

Thu 21.11. Project work. A short introduction to UV astronomy.

Tue 26.11. High-energy space missions II. Gamma-rays, Fermi satellite.

Thu 28.11. **No teaching**. Use this time for group meetings.

Tue 3.12. Project presentations.

Thu 5.12. Project presentations

Groups should also meet outside the lecture times;
there should be at least one extra meeting each week.
Plan your own schedule within which you can reach the goal!

Project report & presentations

- Report includes:
 - an introduction and background section (for example, what has been done before in this area, why this topic was chosen, what are the goals of the project, why is it important...).
 - the main findings (for example, what is the project about, how will the goals be achieved, which technologies, orbits, etc have been chosen, how will these support the project, what is the outcome/results of the project...). Use as many sections as needed.
 - the arguments why certain solutions were chosen.
 - conclusions/summary, estimate of future work and possibilities.
- 5 to 10 pages (A4, normal font size and line spacing).
- Deadline 17.12.2019
- Project presentations on 3. and 5.12.
 - 30?/TBC minutes per group, presentation format is free (sing, dance, or prepare a slide show).

Kick-off today

- **Science cases**
 - *“What do we want to study? Why is it important?”*
- **Instruments**
 - *“With what are we going to do it? What kind of instruments are there for astronomical space research at various wavelengths?”*
- **Orbits and general satellite requirements**
 - *“How do instruments possibly restrict the selection of the orbit? What is needed in the satellite to support the science instruments?”*

Some general instructions...

- Take into account:
 - What can be done and why is it important, how can it be done.
 - Conventional vs. novel solutions; possibilities vs. restrictions.
 - You can be ambitious! Your project may not be quite achievable yet, but a good case and realistic potential is enough.
 - You will need to justify your decisions. "It sounds exciting" will not be enough.

 - This course is not about, for example, orbits or particle physics -> no need to be exact.
 - We are looking for a working concept, not a detailed description.
 - Work out the general concept first, only then concentrate on details.

Possibilities

Science case

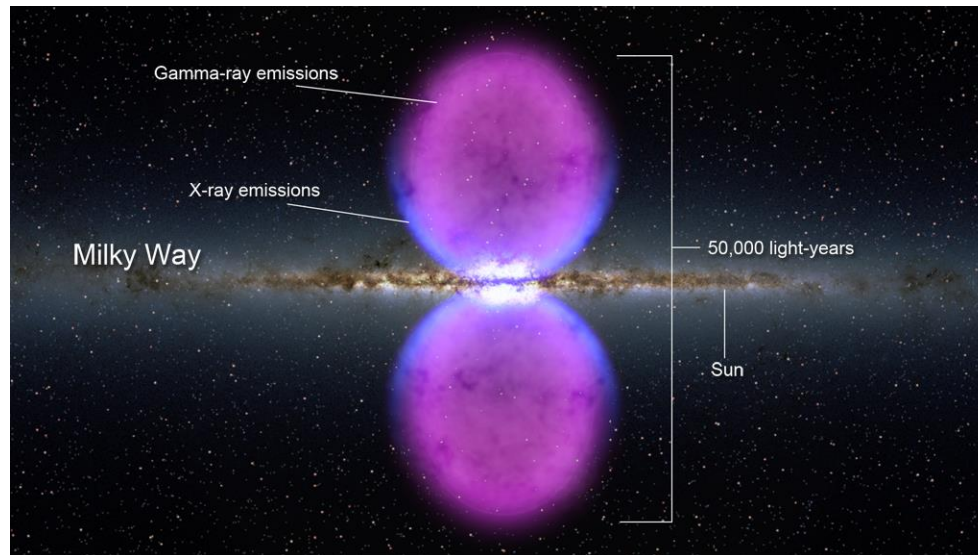
- Solar system (no space physics)
- Stars and exoplanets
- Milky Way
- Galaxies
- Cosmology
- Fundamental physics

Instruments

- Wavelength
- Observing technique (for, example, imaging, spectroscopy etc...)
- Observatory or survey
- ...

Finding your group & topic

- Write down science topics/instruments/wavelengths/... that interest you (~5 min).
- Collect them on the board according to science case/instrument/wavelength/... (~10 min).
- Select your topic and see who else is interested.
 - We are aiming at groups of 4 to 5 people.



In the groups...

- You are responsible for your own schedule and completion of the project.
- Work together! Participate! Be active!
- Help each other.
- Have an agenda for each meeting (*“what do we need to discuss today?”*) and someone to lead the discussion & take notes (*chairperson and secretary*).

Where to start today?

- Identify in the group:
 - what do you already know.
 - what you don't know but need to know.
 - where can you find this information.
 - Make a plan and start working!
 - Agree on the next meeting date & location.
- Write down a clear but simple plan with following information and submit a copy (one per group, max A4) to MyCourses **during next Thursday's (7.11.) lecture at the latest:**
 - Group members and e-mail addresses
 - Preliminary project idea & schedule
 - To do list for all group members = where to start
 - Next "informal" (=outside lectures) meeting: date and time.

Next steps

- Continue working as you planned today. Meet again as needed.
- Next "formal" project meeting on **Thursday 7.11. at 12-14** to get you efficiently started.
- Lecture on **Tuesday 12.11. at 14-16**: Lifecycle of a space mission. Case study: the Planck satellite.
- If you did not yet submit the preliminary plan with group information, do it as soon as possible.

- If interested, you are also welcome to participate in two Radio Astronomy course lectures (in Simlab):
 - Thu 14.11., 14-16, Dr. Hannu Kurki-Suonio: Cosmic Microwave Background.
 - Tue 26.11., 10-12, Prof. Esko Valtaoja: Life in the Universe.