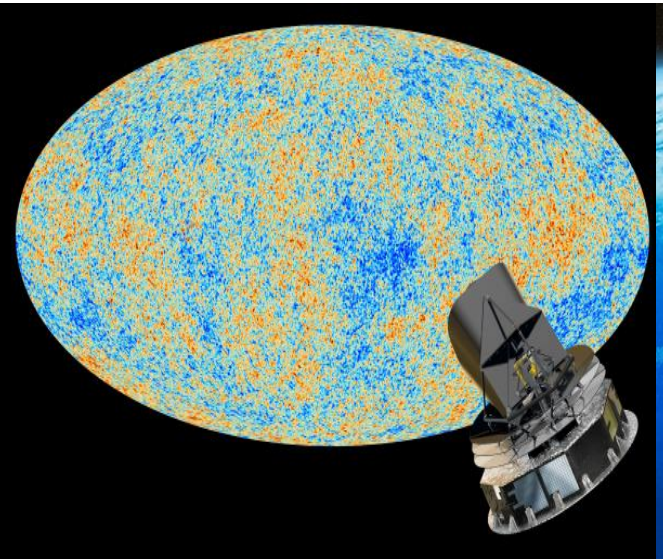
Space Instrumentation ELEC-E4220 (5 cr)

3.11.2020

- Part II project work kick-off.
- Project plan, report, and peer-assessment guidelines.
- Topic selection.

ESA




Design your own astronomical space mission

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.

Plan your own schedule within which you can reach the goal! You are responsible for your own schedule and completion of the project.

Project plan

- Your preliminary project idea, no need to be exact yet:
  - Science case
  - Instruments
  - Orbits and general satellite requirements
- Define also:
  - What do you already know, what you don't know but need to know, where can you find this information.
  - Your schedule for completing the project.
  - To do list for the next steps.
- Maximum two pages (A4, normal font size and line spacing)
- Deadline Tuesday 10.11. at 23.59 (that is, by the end of the day).
  - Feedback will be provided asap.

Project report

- 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.
  - if possible, add also schedule of the mission, cost estimate, sustainability considerations. What about space debris?
  - conclusions/summary, estimate of future work and possibilities.
- 5 to 10 pages (A4, normal font size and line spacing).
- Deadline 14.12.2020 at 09.00

Example contents

…but remember that these were group projects with several people working on each…

Peer-assessment

- Everyone reads two to three other reports and evaluates them according to set criteria.
- Opens right after the report deadline on 14.12.2020 at 09.00
- Deadline 21.12.2020 at 09.00
- Will be done automatically in MyCourses: **deadlines are absolute**, also for submitting the report!!!

- Instructions are given later. We will discuss the concept of peer-assessment and the assessment criteria on the last lecture on 1.12.2020.

Kick-off today

- Science cases
  - *”What do I want to study? Why is it important?”*
- Instruments
  - *”With what am I 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 and creative! 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

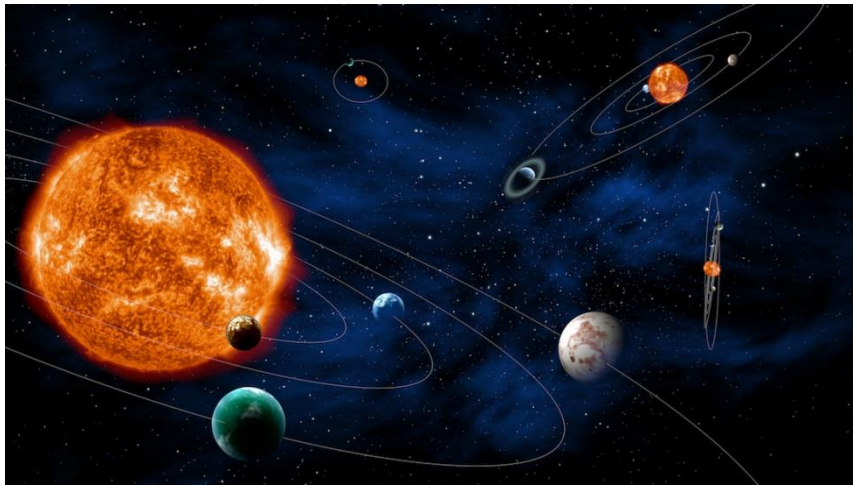
- Solar system (no space physics)
- Stars and exoplanets
- Milky Way
- Galaxies
- Cosmology
- Fundamental physics

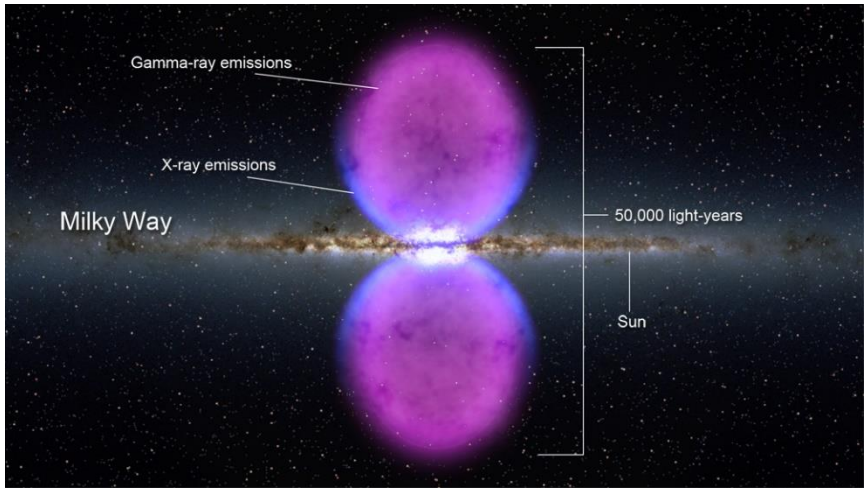
Instruments

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

Example topics from previous years

- Exoplanet observations (in many, many, and various modes...)
- Interstellar mission to a habitable exoplanet
- Measurement of the Hubble constant and the density of dark matter
- The dark matter probe
- Mission to interstellar medium
- Mission to measure the properties/environment of a black hole
- Burst accelerated reaction telescope
- …





Finding your topic

- Go to flinga.fi and use code FVMVMCP
  https://flinga.fi/s/FVMVMCP

- Write down science topics/ instruments/ wavelengths/… that interest you on the Flinga whiteboard. (~10 mins)
  - It works just like post-it notes.
  - *Select "square" and write the text in "message". Edit text by clicking the square you've created. You can also move it around.*

- You can try sorting everyone's ideas into groups of similar topics. Feel free to move the squares around.

- Let's then see what you have come up with.

- Think & select your topic.

Collecting project ideas in Flinga

- You can still go and work with the whiteboard even after the lecture if you like! Have a look at https://flinga.fi/s/FVMVMCP

Where to start now?

- Pick a topic and find out some basic information about it: science case, possibilities for instruments etc…

- Identify:
  - what do you already know about the topic.
  - what you don’t know but need to know.
  - where can you find this information.

- Write down a clear project plan as instructed and submit it to MyCourses by Tue 10.11. at 23.59.

- Start working! No assignments until December, only one lecture per week, no exam, no excuse for delays… You only have ~6 weeks to complete the project!

Resources

- ESA, NASA, other space agencies
  - Red books, blue books, reports…
- University & research institutes
- (Peer-reviewed) articles, use Aalto's library access
  - libproxy.aalto.fi

- If you have problems accessing essential resources, contact me for help: anne.lahteenmaki@aalto.fi.

Next steps

- Project plan help available on **Thursday 5.11. at 12-14** to get you efficiently started. If you have questions, be there. If you are all clear, no need to attend. (You can also send email if you prefer.)

- Lecture on **Tuesday 10.11. at 14-16**: *Lifecycle of a space mission. Case study: the Planck satellite.*

- Project plan deadline Tuesday 10.11. at 23.59.

- Work as planned.

- Questions?