Student Projects

New Astrophysics Missions

Much of astrophysics today relies on new instrumentation

- test existing theories!
- discover the unexpected!
- expand current horizons in
  - energy/wavelength
  - sensitivity (time needed to detect something)
  - resultion (angular and energy)
  - field of view
  - detection "messenger" (photon, cosmic ray, neutrino, gravity wave, ...)

Your task:

Imagine the World Astronomical Funding Agency has issued a call for proposals for new missions

In small groups (6 groups of 5 members)

Propose a new Mission answering one of the calls to answer a question or topic from this school!

- Be creative!
- Don't worry too much about super-low-level details! Focus on science and concept
- This is a way to think about science topics in this school in a different way (and to interact with the lecturers)

Project Specifics

Mission Call (we assign, at least 2 groups each)

- Nano-mission: (<50 M€) cube-sat(s): low cost, small size, short lifetime
- Medium - Large Mission (XXX - 900 M€)
- Ground-Based (100-400 M€)

Science (you choose):

- Help with the knowledge of Gamma Ray Bursts
- Identify the source of Fast Radio Bursts
- Explore the Transient Universe (from binary systems to AGN)
- Improve our understanding of Supernovae or their remnants
- determine the sources of galactic cosmic rays
- *and/or anything else from this school!*

What to think about?

1. **Choose a Science Case**
   - Theorists: what models would you like to constrain, but can't with current technology?
   - Observers: What data would like like to include an a MWL campaign?
   - etc.

2. **Try to come up with science *requirements***
   - What energy band(s) are you interested in?
   - What fluxes are you trying to detect?
   - What sensitivity would you need? (minimum detectable flux)
   - How does this relate to existing missions/observatories?

3. **Think about what *technical concept* that would support those:**
   - What technology is appropriate? (detection area/field-of-view/type of detector, even how much data it might produce and if you can handle it!)
   - What are the constraints?
   - [SEE Henri's Talk for lots of info/ideas]

Resources

- Talk to instructors at this school for help and ideas!
  - we will all be available at on Monday at 16:00-18:00
  - + obviously any time you see us! We're happy to discuss
- Look at the talks the instructors gave and extract useful information / plots / etc.
- Use the internet

Evaluation

at least 2 groups will compete in each category / topic

On Wednesday morning, you will present your proposal:

- 15 minute talks
- show briefly at start *what each group member contributed*
- Some presentation ideas:
  - Science intro
  - Science requirements
  - Mission concept: design and how it meet the science requirements
  - Performance (PSF, sensitivity, field-of-view and repointing speed, ...)
  - expected science return

We will consider your ideas based on (directly from ESA!)**:**

- Scientific value
- Programmatic validity, i.e. possibility of contributing to a balanced and continuous science return;
- High "science for money" rating
- Communication potential
- Technical feasibility
- Cost to Member States (including payload, data processing and distribution, archives etc.)

ESA criteria

Scientific Objectives

- The missions proposed should be described and discussed in relation to current scientific knowledge and technological challenges. Their timeliness as well as the relationship to other existing or planned missions in the same discipline should also be examined.

International Partners

- If international partners are needed, they must be identified already at the level of the Letter of Intent.
- It will be expected that the interest of international partners in the proposed mission be demonstrated at the time of proposal submission, albeit in a preliminary way. At the ESTEC briefing advice will be provided regarding this issue.

Payload Concept

- An example of an instrument complement meeting the scientific objectives should be given. Indication of instrument performance, basic technical parameters (mass, dimensions, power, data rate) and special requirements (such as viewing conditions, pointing requirements and electromagnetic cleanliness) should be provided.
- Guidelines on optimal and cost-effective experiment design, as well as indications about the realism of the funding expectations from Member States will be provided by the Executive at the ESTEC briefing.

Mission Requirements

- The main requirements on mission design should be described, such as: preferred orbits and/or trajectories, operational mode, mission lifetime, particular communication requirements.

Science operations and Archiving

- Expected volume and format of data, site of the active and historical archives, proposed funding source(s) (e.g., PI institutes, national funding agencies, ESA Science Programme).

Technological development requirements

- The technological development requirements should be identified from the earliest planning stages of a mission. Management and Funding
- Information regarding special capabilities and experience in scientific institutes, potential collaborative arrangements and any other relevant programmatic or financial information (e. g. payload, operations and archiving funding).

Communication and Outreach

- The communication potential of the mission should be stressed, and the proposed communication-outreach activities, as well as the means to carry them out should be outlined.