KoF/ÖB 2024

Faculty of Science and Technology

Research Program Self-Evaluation

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| Research Program: | Observational Astrophysics |
| Department: | Department of Physics and Astronomy |
| Section: | Physics |
| Program Responsible Professor: | Nikolai Piskunov |

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| **Goals:*** Maintain and strengthen our **research quality**
	+ Through program and department self-reflection on strengths and weaknesses
	+ Through developing program and department priorities for the next 5 years
	+ Through internal and external feedback on our performance and plans
* Strengthen our **collegial culture**
	+ By involving all research staff in the process and ensuring everyone is aware of the results
	+ By being respectful of everyone’s time at the faculty, department, and program levels
	+ By communicating clearly as to why we are doing this and how we expect everyone to contribute
* Improve our **internal understanding**
	+ By collecting information on the different ways programs and departments are funded and operate
	+ By collecting explanations of why we work that way and how it supports our research
* Improve our **resource usage**
	+ By generating bottom-up prioritized research plans at the program, department, section, and faculty-levels
	+ By allocating and re-allocating resources based our priorities and the potential to significantly improve research
	+ By identifying opportunities for intra- and inter-program/department/section collaboration and re-organization
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**Introduction**

Be sure to regularly [check the faculty KoF24 and ÖB webpage](https://www.uu.se/medarbetare/fakultet/teknisk-naturvetenskapliga/utvardering-av-fakultetens-forskning---kof) for updates, clarifications, details, timelines, and answers to common questions.

**Background on KoF and ÖB**

This evaluation combines two processes: the university-wide Quality and Renewal (KoF) process and the faculty-level Review of Base Financing (ÖB). These are being combined to avoid significant duplication of effort. However, they have different goals which makes combining them a challenge. For example, the first three goals above are KoF-focused while the last is ÖB-focused. Most importantly, KoF is a reflective process where we strive to identify both our strengths and weaknesses, while ÖB is an evaluative process where we strive to identify the best opportunities for using our resources.

This causes an inherent concern: will admitting to weaknesses in KoF make us less likely to get resources from ÖB? While there is no way to completely eliminate this concern, this evaluation has been designed with the ÖB portion focusing on identifying Priorities to improve/strengthen/broaden research while the KoF portion focuses primarily on reflecting on our processes.

This provides the ability to be open about weaknesses while ensuring prioritization of high-quality ideas, as

1. Using Priorities allows us to identify concrete opportunities to improve our research, thereby allowing reflection on not just where we are currently excellent but where we can become better, and,
2. Using an internal, bottom-up prioritization process at the program, department, section, and faculty-levels allows us to identify the most promising and high-quality proposal for potential funding at each level.

**Expectations**

There is understandably a strong focus on the “new” funds that will be allocated as part of the ÖB process. However, these funds are small in comparison to the yearly budget, and the Faculty strongly encourages everyone to look to the four goals listed on the first page for the main value of this process. Please be aware that this report will be a public document and will be placed on the faculty website for all employees to access.

**Time period**

This evaluation pertains to the period since the last evaluation: 2019-2023 inclusive. Descriptions provided by the programs should cover the full evaluation period. However, centrally provided statistics on bibliometrics (2017-2021/2022) and financial data (2022-2023) cover slightly different time periods.

**Responsibility**

The Head of Department (HoD) has the overall responsibility for the department self-evaluations and the Program Responsible Professor (PAP) has the overall responsibility for program self-evaluations. This includes ensuring that the information provided is both sufficiently accurate and not misleading. It is important to be open, even about activities that are not as successful as we may wish.

The HoD/PAP is responsible for coordinating meetings with the appropriate people, collecting input, leading appropriately broad and inclusive discussions, prioritizing among suggestions, and summarizing and producing the final text. Most economic and HR data will be provided centrally, but for the information that needs to be collected locally, the HoD/PAP is responsible for coordinating with the appropriate people. The HoD is responsible for ensuring that the programs provide drafts to the department early enough that the department can use them as input to the department’s self-evaluation.

**Panels**

The panels will provide input on how programs and departments can improve, provide new perspectives on potential organizational changes across programs and departments, help in identifying good examples that can be shared across the faculty, and place our research quality in the international context. While this input is extremely helpful for identifying directions, decisions and prioritization will be done within the faculty using the panel’s feedback as one input.

**Instructions**

**Base data**

Base data such as bibliometrics, HR and financial data will be provided centrally. Details on how the data was collected and how to interpret it will be found in the Base Data Information document on the Faculty KoF webpage.

**Note**

While it is understandable that every program and department will want to look as good as possible, this process is most valuable when everyone is open and honest. In particular:

1. Activities (funding, projects, publications, hires etc.) that ended before the evaluation period or started after it should not be included. If it is extremely important to include such, e.g., very recent recruitments that significantly affect future plans, the text must clearly indicate that the activity falls outside the evaluation period and why it is being included.
2. Cramming in more text by changing the font size, layout, margins, text box sizes, etc. will not be accepted. It is understood that the space limitations will lead to the need for careful prioritization.

The four answer sizes used are:

* Very short – 1.4cm tall box, approximately 250 characters
* Short – 3cm tall box, approximately 600 characters
* Medium – 4.7cm tall box, approximately 950 characters
* Long – 10cm tall box, approximately 2000 characters

Do not change the ordering or labeling of the questions in the document, as the final answers will be extracted from the document based on that ordering and labeling.

**Before submission**

[Check the KoF/ÖB webpage on the employee portal for any important updates](https://www.uu.se/en/staff/faculty/science-and-technology/research).

**Hide instructions**
Modify the “Instructions” style so all colored text is hidden in the submitted document. First, check that you have the “Show/Hide Formatting Marks” turned off then right-click on the style “Instructions” in the ribbon at the top of the window. Then select “Modify” and then “Format” at the bottom left. Choose “Font” and turn on the “Hidden” option and click the OK button.

**Navigation panel**

To quickly navigate through the document, you can use the Navigation panel. To see the Navigation panel, click the “View” tab in the ribbon and then check the “Navigation Panel” checkbox in the “Show” button group or choose “Sidebar🡪Navigation” from the “View” menu. In the Navigation Panel you can view the outline of the document and search for specific words or phrases.

**Submission**

Send this document as **a Word file** to your Head of Department latest April 15, 2024. It is important to submit the document as a Word file as we will be extracting text from the tables to put all answers in a database.

**Updates**

* V4
	+ Clarified in table 3.9 that Top-10 external funding shows the amount spent on each financier during the year.
	+ Corrected data for some programs with regard to “UL, promoted from an adjunct” being included in the category “Other Research”. Those concerned have been informed by e-mail.
	+ Updated data for the Instrumentation Research Program including FREIA.
	+ Added a box where the program can ask questions to the panel.
* V3
	+ Revised bibliometrics table to have only one coverage statistic (3.3.2). This statistic reflects the proportion of DiVA publications used for citation statistics calculations by CWTS Leiden, instead of reporting the Web of Science coverage (WoS coverage). For WoS coverage statistics, see the base data document. The intended goal is to put increased focus on the impact indicators and their validity.
* V2
	+ **3.10 External funding sources** - Changed to include all “active” grants during the evaluation period instead of just grants that “started” during the evaluation period. This change is done to make sure that grants that show up in the financial data for 2022 and 2023 will be listed even if they did not start during the evaluation period
* V1 (initial version)

# General information

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

## Process for creating this self-evaluation

**Instructions**: Describe the process to generate this self-assessment, how it was collegial, and list which categories of employees (e.g., Professors, ULs, BULs, postdocs, PhDs, researchers, etc.) were significantly involved.

Motivation: To emphasize that this is to be a collegial process and that all members of the program should be included.

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| The 1st draft was written by the PAP and circulated among all program members. Comments were merged and integrated in the form and the content was discussed at the program meeting. Final changes were added after Department-wide presentations and discussions. |

## Core of the research program

**Instructions**: Describe what makes the program a coherent research program. For example, shared methods, areas, questions, facilities, etc.

Motivation: To understand the essence of the program so that its plans and activities can be better understood in that context.

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| The program uses advanced and systematic observations to derive new knowledge about specific types of astronomical objects and the Universe as a whole. We actively use physical and numerical modelling for the interpretation of our observations and contribute to the development of major astronomical facilities. |

## Personnel (data provided centrally)

**Instructions**: Postdocs who are on stipend should be listed separately in parentheses. (Example: if there are 4 postdocs on salary and 3 on stipend, please enter “4 (+3)”. )

Motivation: To understand the program’s personnel distribution by career stage and gender. This data shows the number of FTEs (full-time equivalent) employees in each category.

Responsibility: Data provided centrally; PAP to review to ensure no significant mistakes are made. Note that stipend postdocs are not present in the university salary system and will need to be manually accounted for if they are to be included. If this table is changed to add stipend postdocs, please note the changes in the “other important program-specific comments” section below as well.

|  |  |  |
| --- | --- | --- |
|  | **Faculty FTEs** | **Non-Faculty FTEs** |
|  | **Professor** | **Associate (UL)** | **Assistant (BUL)** | **Total** | **PhD** | **Postdoc** | **Researcher** | **Other****Research** | **Other** | **Total** |
| **Female** |  | 0.8 |  | 0.8 | 1.9 | 0.7 |  |  |  | 2.6 |
| **Male** | 1.5 | 2.5 |  | 4.0 | 3.7 | 3.0 | 2.0 | 0.3 |  | 8.9 |

## Finances

### Overall research funding in MSEK (data provided centrally)

Motivation: To understand how a program is funded across the main sources of income. This data shows the long-term internal funding (FFF+SFO) vs. external (grant) research funding.

Responsibility: Data provided centrally; PAP to review to ensure no significant mistakes are made.

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| --- | --- | --- | --- | --- | --- | --- |
|  | **FFF+SFO Internal Research** | **Other Internal Research** | **Total Internal Research** | **External Research** | **Total Research** | **External Research %** |
| **2023** | 3.8  | 1.4  | 5.3  | 16.6  | 21.8  | 76% |
| **2022** | 3.8  | 1.7  | 5.5  | 12.6  | 18.1  | 70% |
| **Average** | 3.8  | 1.6  | 5.4  | 14.6  | 20.0  | 73% |

### Other internal research funding

**Instructions**: If the other internal resources category above is significant, describe where it comes from: e.g., co-funding for various grants, starting packages for Assistant professors, studiestöd, department resources given, special funds from the vice rector, etc.

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| Program researchers are actively using the sabbatical possibilities offered by the Center for Advanced Studies (SCAS, 4 people) and AI4Research (2 people).  |

### Basic funding expectations and policy for using internal resources

**Instructions**: Explain the standard funding distribution between internal research funding (FFFs), external grants, and teaching that faculty (Assistant, Associate, Professor) and non-tenure staff (researchers, adjuncts) receive. Describe the policy for distributing internal resources (FFFs and other 210 funds, including studiestöd, startbidrags, and co-funding). Include a description of how faculty members at each level (Assistant, Associate, Professor) receive research support and are funded. Explain any implicit or explicit policies regarding holding external grants and allocation of internal resources. Include a brief overview of other uses of internal resources, for example: extra support for particular roles (e.g., PAP, FUAP), startup packages (for new faculty), allocation of studiestöd, department policies for FFFs or institution resources, funding of joint facilities/infrastructure, co-funding for grants, paying for PhDs/postdocs, etc.

Motivation: To understand how programs use their internal resources to support members and activities.

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| Faculty salaries are in average paid in equal parts from external grants and from the program internal resources. Teaching pays the rest. We tried not to overcommit the FFFs as insurance against negative outcome of external grant applications. PhD students are mostly paid from external grants. We see a tendency of using less internal funding for PhD students. Other use of internal resources is co-funding of the external large projects and startup package for the newly recruited staff (lecturer in 2024). There is no extra support for PAP or FUAP duties. We have also received departmental support for upgrades of our file server crucial for running MARCS and VALD databases, and instrumentation development. |

### Use of internal research funds in MSEK (data provided centrally)

Motivation: To understand how the program is using internal research funding.

Responsibility: Data provided centrally; PAP to review to ensure no significant mistakes are made.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Faculty Salary | Non-Faculty Salary | Other Personnel Costs | Premises | Equipment Depreciation | Overhead | Running Costs | Total |
| 2023 | 1.3 (35%)  | 1 (28%)  | 0 (1%)  | 0.5 (15%)  | 0 (0%)  | 0.7 (18%)  | 0.1 (3%)  | 3.6  |
| 2022 | 1.7 (37%)  | 1.2 (26%)  | 0 (1%)  | 0.7 (15%)  | 0 (1%)  | 0.8 (18%)  | 0.1 (3%)  | 4.7  |
| Average | 1.5 (36%)  | 1.1 (27%)  | 0 (1%)  | 0.6 (15%)  | 0 (0%)  | 0.7 (18%)  | 0.1 (3%)  | 4.2  |

### Personnel funding (data provided centrally)

Motivation: To understand how funding is used across different employment categories and genders. This data shows how staff are funded on average across internal and external research funding as well as teaching.

Responsibility: Data provided centrally; PAP to review to ensure no significant mistakes are made.

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| --- | --- | --- |
|  | Female | Male |
|  | Internal | External | Teaching | Internal | External | Teaching |
| Professor |  |  |  | 43% | 33% | 23% |
| Associate (UL) | 0% | 67% | 33% | 31% | 14% (should be 40%) | 55% |
| Assistant (BUL) |  |  |  |  |  |  |
| PhD | 7% | 88% | 5% | 41% | 49% | 10% |
| Postdoc | 0% | 100% | 0% | 8% | 92% | 0% |
| Researcher |  |  |  | 10% | 79% | 12% |

### Major infrastructure usage

**Instructions**: Identify the five most significant research infrastructures used by the program. For this purpose, infrastructures are resources that are too expensive for an individual PI to afford and are therefore organized and funded as shared resources. Specify the level of sharing (program, department, university, national, or international) and whether it is located at Uppsala or elsewhere. Provide the approximate amount spent to pay for development of or access to the infrastructure each year, including both program funds and PI grant expenditures. Infrastructure costs should not include travel to the infrastructure (as travel for research is not infrastructure-specific) nor salary time while using the infrastructure (as research time is not infrastructure-specific), but can include salary costs of engineering staff and explicitly agreed upon in-kind salary contributions. If infrastructure is paid for outside of the program, specify who pays for it instead of the cost. (E.g., write “Faculty” or “VR”.) Note that it is not necessary to provide exact values, but please make an effort to be within ~10%.

Motivation: To understand what important infrastructure is being used and how much it costs and to support the faculty’s ongoing work on developing an infrastructure policy

Responsibility: PAP in discussion with program members, economic administrator for costs.

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| --- | --- | --- | --- |
| Infrastructure | Sharing | Location | Approximate Yearly Cost(MSEK) |
| ESO Paranal & La Silla observatory | International | Chile | VR |
| ESA/NASA HST, Gaia, JWST, TESS, Plato | International | Space | Space Board |
| Terra Hunting Experiment | International | La Palma | 0.6 |
| VALD, MARCS | International | UU | 0.2 |
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## Other important comments

**Instructions**: Explain any important issues not addressed above or misrepresented by the above data that need to be clarified for the panel to give valuable feedback. If the program has an important role in supporting the university or department, such as a mandate from the government or university, please describe it here. Please keep these precise and relevant.

Motivation: To bring important and special issues to the view of the panel and department.

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| Unlike other fields, astronomical infrastructure comes fully equipped to do science. The telescopes are usually built by international organizations (ESO, NASA), but the instruments are produced by consortia of universities. UU is actively participating in such projects but the costs are not included in the table. |

# Follow up on goals set in the last evaluation

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

## Reflections on accomplishments and setting goals this time

**Instructions**: Reflect on whether the goals from the last evaluation (ÖB Section D1 for programs and KoF17 Section 1b for departments) were appropriate in retrospect, what has been accomplished towards them since the evaluation, and what we can learn from them about setting effective goals this time. The previous evaluations [are available on the faculty KoF webpage](https://www.uu.se/en/staff/faculty/science-and-technology/the-facultys-research-evaluation---quality-and-renewal---kof24) to support this reflection for the programs, departments, and panels.

Motivation: Try to learn from what we did last time to be able to set more effective goals this time.

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| KoF17 report was focused on gender equality, fuzzy career development plans, lengthy recruitment procedures and confusing organization. We did work within a program on all these aspects with some success (e.g. addressing VR’s gender bias). For ÖB19 we proposed a new general theme of our research “Conditions for Life in the Universe” and today it does unify most of our work starting from the chemical evolution of galaxies and mapping of the Milky Way to exoplanet atmospheres; from stellar magnetism to star-planet interaction. We also expanded our efforts in astronomical instrument development for the ELT. Career development plans now includes pedagogical training, external grant and infrastructure applications. |

# Area 1: Research Quality (evaluation of outcomes and processes)

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

## Main research areas

**Instructions**: List the largest research areas in the program, including approximately what percent of the program’s total research they cover, the approximate number of FTE faculty (Assistant/Associate/Professor, split according to their approximate activities and not double-counted), and whether the research is mostly Applied, Basic Science, or Mixed. These four areas combined should be broad enough to cover at least 75% of the program’s research activities.

Motivation: To understand the program’s research heterogeneity and how the program sees its own research profile and to help in assigning panel members.

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| --- | --- | --- | --- |
| Main Research Areas | % of program | FTE Faculty | Type |
| 1 | Exoplanets and their host stars | 40 | 0/1/1 | Basic |
| 2 | Mapping of the Milky Way | 20 | 0/1/0 | Basic |
| 3 | Galaxy formation and evolution | 20 | 0/1/0 | Basic |
| 4 | Stellar magnetism | 20 | 0/0/1 | Basic |

## Research Activities

**Instructions**: Describe the key research activities in the program. This should focus on the types of research done, with the important results described later in the Research Results section. Briefly describe how the research is important for science and society. Describe how the program balances incremental (e.g., safe, easy-to-publish) research with higher-risk projects with more potential for breakthroughs. Note that the limited space will require prioritizing the text based on the main research activities listed above.

Motivation: Provide a more detailed view of the key research directions in the program.

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| Exoplanets and their host stars: observational search for exoplanetary atmospheres and their characterization. As part of the guaranteed time at ESO’s VLT telescope we have observed multiple transits of a few hot jupiters and earth-like planets. We have derived chemical composition of the atmospheres of hot jupiters and we are working on a novel and significantly more efficient method for the earth-like planets. ESA's Plato space mission to be launched in 2026 will search for nearby exoplanets. Program members are involved in the determination of the properties of the host stars, which Plato will observe.Mapping of the Milky Way: we are part of the consortium handling the data from ESA’s Gaia space mission (the 3rd data release was in 2022) and of various spectroscopic follow-ups including instrument development (4MOST, ELT/ANDES, ELT/MOSAIC). Program members are contributing to data processing and analysis of the Gaia space mission, which has been collecting accurate measurements of nearly 2 billion stars in the Milky Way Galaxy, including abundances of chemical elements. This topic also involves lots of outreach activities, public talks, school visits etc. The work is closely connected to the European network on the origin and evolution of elements in the cosmos (ChETEC-INFRA, with science, science education and outreach activities).Galaxy formation and evolution: observational studies of galaxies, black holes and gravitationally lensed stars in the early Universe, using a combination of ground-based telescopes like VLT and ALMA, space telescopes like HST and JWST, and models geared specifically to the interpretation of such data.Stellar magnetism: we develop and apply techniques for detecting and characterizing magnetic fields on the surfaces of stars. This research contributes key observational constraints to stellar evolution theories and sheds light on the conditions in which exoplanets form and evolve. Our investigation of stellar magnetic fields informs about likely short- and long-term development in the magnetic activity of the Sun, with implications for space weather effects on the Earth and on human civilization. |

## Research Results

### Contributions to the field

**Instructions**: Describe the research results that the program is particularly proud of that indicate the quality and breadth of the research. Explain the importance of the program’s contribution to the field in the international context.

Motivation: Identify the results the program is most proud of and provide the program’s perspective on how important they are. This allows the panel to see how the program sees itself and provide feedback to help the program better understand how it is viewed internationally.

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| Our most significant research efforts are related to the studies of **stars**, the history of star formation in our and other galaxies, their role in local and global environments including stellar magnetism, chemical enrichment, hosting exoplanets and re-ionization of the Universe. Our impact comes from systematic studies of these phenomena using state-of-the-art facilities, mostly producing spectroscopic data. We are also providing major contributions to the developments of these unique facilities (ESO VLT CRIRES+, ELT ANDES; ESA missions Gaia and Plato, ESO 4MOST). |

### Bibliometrics for 2017-2021/2022 (data provided centrally)

Motivation: Provide an overview of how the program is performing that is reasonably comparable to other programs and departments. (See the Base Data definitions file for the meaning of each statistic.)

|  |  |  |
| --- | --- | --- |
|  | Type of Indicator | 2017-2022 |
| Number of publications, full publication set (full / fractional counts) | Quantity | 255 / 57 |
| Proportion of publication fractions at the Norwegian model level 2 (%) | Impact | 53% |
|  |  | 2017-2021 |
| Coverage (fractionalized): Proportion of publications from DiVA included in citation statistics, weighted by fractional counts | Coverage | 76% |
| Mean normalized number of citations per publication (MNCS) | Impact | 1.02 |
| Proportion of frequently cited publications (top 10%) (PP(top 10%)) | Impact | 9% |

### Most frequent publishing channels (raw data provided centrally)

**Instructions**: Using the provided raw data of publication frequency per channel (a channel is the name of a conference or journal) for each program, list the most frequent publishing channels with more than two publications during the evaluation period. This data can be found in the Base Data Excel document.

Motivation: To see where the program is most frequently publishing.

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| --- | --- | --- |
| Channel | Number  | % of Total Publications |
| Monthly Notices of the Royal Astronomical Society | 68 | 27 |
| Astronomy and Astrophysics | 63 | 25 |
| Astrophysical Journal | 45 | 18 |
| SPIE | 10 | 5 |
| Cools Stars, Stellar System and the Sun | 8 | 4 |
| Nature | 5 | 2 |
| Astronomical Journal | 4 | 2 |
| Solar Physics | 2 | 1 |
| Journal of Quantum Spectroscopy and Radiative Transfer | 2 | 1 |
|  |  |  |

### Most important publishing channels

**Instructions**: Provide the most important publishing channels (a channel is the name of a conference or journal) according to the program, the number of publications in each channel during the evaluation period, and the % of the total publications based on the centrally provided bibliometrics. For each channel, specify both the total number of publication and the number where a program member was the lead-author. (The lead-author is the primary driver of the particular publication, which is often denoted as the “corresponding” author or the first author in the publication list, and is typically the originator of the core idea of the work and/or the person who wrote the majority of the text in the publication.)

Motivation: Enable the program to indicate what publishing channels they see as most important and how much they publish in them for panel feedback.

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| --- | --- | --- | --- | --- |
| Channel | Number  | % of Total Publications | Lead-author  | Lead-author % of Total  |
| Monthly Notices of the Royal Astronomical Society | 68 | 27 | 32 | 47 |
| Astronomy and Astrophysics | 63 | 25 | 22 | 35 |
| Astrophysical Journal | 45 | 18 | 3 | 1 |
| SPIE | 10 | 6 | 3 | 33 |
| Cool Stars, Stellar Systems, and the Sun | 8 | 4 | 6 | 75 |
| Nature | 5 | 2 | 0 | 0 |
| Astronomical Journal | 4 | 2 | 2 | 50 |
| Solar Physics | 2 | 1 | 0 | 0 |
| Journal of Quantum Spectroscopy and Radiative Transfer | 2 | 1 | 0 | 0 |
|  |  |  |  |  |

### Publishing impact on the field

**Instructions**: Describe the impact of the program’s publishing on the field by elaborating on the provided bibliometrics, the most frequent publishing channels, and the self-identified most important publishing channels. Explain the importance of the program’s contribution to the field in the international context. (See the Base Data definitions file for the meaning of the bilbiometric statistics.)

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| The publication list is the work of 13 people over 5 years. On average we produce more than 4 journal papers per year per person (considering that typically several people from the program collaborate on each paper). This is well above the average 3 papers-per-year output across Western Europe and comparable to the best observational astronomy centers in the world. We are certainly presenting our research results in the leading astronomical journals. We could be more ambitious in taking lead roles when publishing results of large international collaborations that we are part of, especially in connection to publications in high-prestige journals like Nature. |

### Participation, recognition, and leadership in the field

**Instructions**: Describe how the program interacts with the larger field in terms of its participation (e.g., through collaborations, professional organizations, positions of trust, etc.), recognition (e.g., through awards, keynote presentations, etc.), and leadership (e.g., through steering positions in international organizations, professional bodies, etc.) in the field. Explain the importance of the program’s contribution to the field in the international context.

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| Program astronomers actively participate in large international collaborations, infrastructure development, observing proposals and joint research initiatives. E.g. we are part of several major surveys such as Gaia, Gaia-ESO, Galactic archeology with 4MOST, the Terra Hunting Experiment, Plato etc. We are also participating in instrument development: e.g. CRIRES+ for the VLT, ANDES and METIS for the ELT. In several of these UU astronomers are members of the project board, lead work packages and management. We are considered to be one of the world-leading centers in all aspects of astronomical spectroscopy, from instrumentation and observations to advanced analysis and modelling. |

## Synergies within the research program

**Instructions**: List up to three examples of synergies (interactions that provide more value than the individual contributions alone) within the research program itself that can be seen through specific on-going collaborations. Synergies can include using similar or complementary methods, facilities, partners, goals, etc. Briefly describe the synergy and extent of the current collaboration. Due to the limited, programs will need to work internally to identify the collaborations that are most important to the program.

Motivation: Identify how the program’s diversity supports its research.

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| --- | --- | --- |
| 1 | Type of synergy | Sharing instrument knowledge and data reduction tools for spectroscopy |
|  | Specificcollaboration | Advanced data reduction methodology and tools developed in the program are used across various projects, also outside UU, to achieve the best quality of observed spectra. |
| 2 | Type of synergy | Sharing spectral synthesis tools across various projects |
|  | Specificcollaboration | A few such tools are publicly available and are actively used by astronomers world-wide. E.g. SME, Synth3 etc. |
| 3 | Type of synergy | Maintaining support databases such as VALD with national and international access |
|  | Specificcollaboration | VALD is a database of atomic and molecular data. Every 3rd professional astronomer in the world is a registered client of VALD. VALD is used in nearly all program projects. |

## Synergies across research fields

**Instructions**: List up to three examples of synergies (interactions that provide more value than the individual contributions) the research program has with research fields other than those of the program itself. Synergies can include using similar or complementary methods, facilities, partners, goals, working across theory/experimental, grants together with people in different fields, etc. These synergies can be here in Uppsala or at other universities. Provide the university (cross-field synergies within Uppsala are fine) and the different field, and briefly describe what the synergy is and the extent of the specific current collaboration. Due to the limited space, programs will need to work internally to identify the collaborations that are most important to the program.

Motivation: Identify current activities that are broader than the research programs to promote broader research initiatives and understand what is done across Uppsala vs. externally.

|  |  |  |
| --- | --- | --- |
| 1 | University and Field | Interactions with the Theoretical Astrophysics program |
| Type of synergy | Combining theory and observation, sharing tools and data. |
| Specificcollaboration | Theory provides atomic and molecular data, stellar model atmosphere, non-equilibrium corrections. It is used to interpret processed spectra and construct semi-empirical models. |
| 2 | University and Field | Mechanical workshop |
| Type of synergy | Infrastructure development projects |
| Specificcollaboration | Astronomical instruments for ESO: HARPSpol, CRIRES+, ANDES, MOSAIC |
| 3 | University and Field | IT department, AI4Research initiative |
| Type of synergy | AI and machine learning methods |
| Specificcollaboration | Three members of the program were on AI4Research sabbaticals, leading to many fruitful collaborations with the IT department on the topics related to AI/ML. |

### Reflections on synergies across research fields

**Instructions**: Reflect on the program’s initiatives and challenges with regards establishing research activities that cross between the program’s field and other fields. Are there particular benefits to such collaborations or particular costs? Describe the formal and informal initiatives the program takes to encourage these and the pros and cons of working within and outside of Uppsala.

Motivation: Understand how the program views its synergies across research fields.

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| There are two reasons why synergy is so important and efficient between the two astronomy programs and much less so with the rest of the University. First, physical conditions (temperature, density, chemical composition) of our targets are dramatically different. Second, our targets are so remote that we can only study them as complex systems. The observational program uses advanced observations as a starting point for research but since our targets are so remote we need modelling to interpret the data. This is why we are successful in setting up collaborations related to computational techniques and methods, as reflected by our active participation in the AI4Research initiative. |

## Reflections on ensuring good research ethics

**Instructions**: Reflect on the program’s initiatives and challenges with regards to ensuring good research ethics. Describe the formal and informal initiatives the program takes to teach and promote good research ethics across all research staff, and what particular challenges the program faces in these regards.

Motivation: Understand how the university’s priority for ensuring good research ethics is addressed.

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| Many papers going into publication are presented to the program or to the whole Division. Supervisors have responsibility for quality and ethical aspects of the papers prepared by the students. PhD students present their thesis and publications several months before the defense to the Division. |

## Reflections on creating and ensuring research freedom

**Instructions**: Reflect on the program’s initiatives and challenges to create and ensure research freedom. Describe the formal and informal initiatives the program takes to create opportunities for research freedom across all research staff, and what particular challenges the program faces in these regards.

Motivation: Understand how the university’s priority for ensuring research freedom is addressed.

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| There is no restriction of the direction of research within the program. The main question is the availability of resources and a revision of research is often associated with recruitment. New initiative gets help in collaboration with other programs or/and with the Department if the proposed project is interesting. |

## Reflections on research program size

**Instructions**: If the research program has 4 or fewer faculty (Assistant, Associate, Professor), describe the program’s process for ensuring a sufficient critical mass of faculty long-term, current and planned activities in this direction, and discuss whether there are other programs where collaboration could be of assistance. Similarly, if the research program has 10 or more faculty members, describe how the program works to develop a coherent research agenda and collaborations. If the program has between 5 and 9 faculty, describe if increasing or decreasing the size could be beneficial.

Motivation: A reasonable number of faculty members is required for research programs to achieve their purpose of providing a collegial environment that can develop and support diverse ideas and knowledge around a shared core research direction. For research programs with very few faculty, or very many, it is important to reflect on how this can be achieved.

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| The program includes 5 faculty and a number of postdocs and PhD students. This is on lower side but things will change with the recruitment of the new lecturer (2024). Retirement of one of the professors (2026) will require further recruitments. We would also like to keep a significant number of postdoctoral positions. |

## Top external funding sources (data provided centrally)

Motivation: To see the amount spent on each financier during the year.

|  |  |  |  |
| --- | --- | --- | --- |
| Funding Agency | 2022 | Funding Agency | 2023 |
| Wallenberg Foundation (KAW) | 4.6  | Wallenberg Foundation (KAW) | 8.8  |
| Swedish Research Council (VR) | 3.1  | Swedish Research Council (VR) | 2.8  |
| Swedish National Space Agency | 2.5  | Swedish National Space Agency | 2.0  |
| Uppsala University Foundations Management (Tamms) | 2.0  | Uppsala University Foundations Management | 1.7  |
| EU commission (H2020) | 0.3  | EU commission (H2020) | 1.2  |
| Royal Swedish Academy of Sciences | 0.1  | Royal Swedish Academy of Sciences | 0.0  |
| Other non-profit (within the EU) | 0.0  | Olle Engkvist Foundation | 0.0  |
| Other private foundations | 0.0  | Other private foundations | 0.0  |
| Olle Engkvist Foundation | 0.0  | Other non-profit (within the EU) | 0.0  |
|  |  | Company (within the EU) | 0.0  |

## External funding sources

**Instructions**: List the source and number of significant research grants to the program during the evaluation period. Include only grants that awarded at least 3M SEK to a program member and were active (used) during the evaluation period (2019-2023, inclusive). If a program member was awarded at least 3M SEK, but was not the PI on the grant, list the grant on a separate line and state “Co-PI”.

Motivation: This list complements the top external funding sources by providing consistent data for significant (>3M SEK) basic science grants available to all programs and by identifying the number of PIs vs. the total amount of funding. This is important as the absolute amount of money available to different fields varies enormously.

|  |  |
| --- | --- |
| Grant | Number of awards to PIs in the program |
| Basic science grants (available to all fields in the faculty) |
| ERC-StG, ERC-CoG, ERC-AdG, ERC-SyG |  |
| KAW Project |  |
| KAW Scholar | 1 |
| WAF/WAFx |  |
| VR Project | 1+ |
| VR Starting |  |
| Other grants (may include field-specific grants and Co-PIs) |
| SNSA | 1+1 |
| VR RFI | 3 |
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## Reflections on external funding

**Instructions**: Reflect on what the program expects from its staff (Assistant, Associate, Professor, postdoc, and researcher levels) in regards to applying for and receiving external funding, how the program communicates those expectations, how the program supports staff in applying for funding through feedback and mentoring, and what opportunities and challenges the program sees in the future for continued and new external funding. Describe initiatives the program takes to form consortia to apply for larger grants.

Motivation: Connect how the program works with external funding to the achieved funding results.

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| Members of the program are expected to raise external funds to do research. This includes the actual research money and often a significant part of their salary (20-50%). The program tries to analyze the outcome of grant applications and reviews the feedback to identify the strong and the weak aspects and to help the members of the group to be more successful. We also try avoiding submitting too many applications to the same round. More systematic work is done at the Division level as many applications, such as ERC and KAW must be coordinated between the programs and across the divisions. |

## Reflections on what is working well

**Instructions**: From the above, reflect on what is working well and should be continued over the next 5 years.

Motivation: Require programs to identify where current activities are successful. This will provide the panel with insights into our own self-assessment.

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| --- |
| The preparation of applications for external funding gets useful support at the Division and Department levels. This includes help with budget, calculations of overhead, exploring co-financing possibilities etc. Even more help is available for large grants from the ERC and KAW. Such applications are also discussed between the programs and with the Division head from the perspective of strategic planning and shared resources. The outcome of the previous rounds is analyzed and is used to help with proposal writing and (if the proposal includes a new staff) with selection of the best applicant. Collaboration between programs is crucial for the success of large applications while maintaining the focus of research topics. |

## Reflections on what needs to be improved

**Instructions**: From the above, reflect on what needs to be improved over the next 5 years. Please focus on areas that need improvement and do not list areas that could be improved but where it is not needed.

Motivation: Require programs to identify where they feel that they need to invest. This will both provide the panels with insights into our own self-assessment as well as help us improve.

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| Discussions of possible changes in research directions should be made more regular and more inclusive to make junior staff more interested and responsible for the future of the program. In particular:* Organizing training and support for writing applications aimed at junior staff.
* Encouraging PhD students to apply for relevant funding opportunities among scholarships and stipends available at UU, KVA etc.
* Considering cross-disciplinary sources of funding such as topical centers (e.g. ML and AI), joint PhD schools, etc.
* Expand these and other activities to the Unit level.
 |

# Area 2: Career Paths (evaluation of processes)

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

## Career stage distribution implications and plans for the next 5 years

**Instructions**: Describe the implications of the current distribution of faculty across career stages (e.g., Assistant, Associate, Professor from Section 1) for the program currently and in the next 5 years. In particular, identify up-coming faculty retirements and/or recruitments and discuss and how the program plans to work with those changes to maintain the program’s core strengths as well as evolve in new directions.

Motivation: Provide perspective on the current status and future changes in personnel in the program.

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| With the upcoming arrival of a new UL (2024), the number of faculty members in the program will increase to 6, which we consider optimal given that each of them supports and works with several researchers, postdocs and PhD students. In a few years (2026), one of the professors in the program will retire while some of the current ULs will likely be promoted to professors. On the time scale of 5 years, we aim to recruit at least one BUL or UL to maintain the current leadership position in the field of instrumentation development and exoplanet research. |

## Reflections on the process for identifying recruitment needs and focusing areas

**Instructions**: Pick a specific faculty-level recruitment during the evaluation period reflect on how the process of identifying the need for recruitment and focusing the research area worked. First describe the recruitment, e.g., Assistant/Associate/Professor-level and research area. Then discuss how the program worked to identify the need for a recruitment in this area, including discussing how the need was identified, how was it discussed and revised in the program, who was involved in the discussions, etc. For focusing the research area, describe how the balance between continuing existing areas vs. choosing new ones was discussed, who was involved in the discussions, what criteria were discussed to ensure that this direction would strengthen the program, etc. If the program has not done any faculty recruitments during the evaluation period, please reflect on how they would be undertaken.

Motivation: Explain how recruitments are currently motivated and decided

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| The program will employ a new UL in 2024. The research area for this position was defined in collaboration with the theoretical astrophysics program and covered all scientific areas at the division. The resulting pool of 65 applicants was the largest the department ever experienced. Future recruitment(s) will be more focused on the strategic areas of the program where we have our strength and expertise. In particular, we will need to fulfill our commitments in various instrument development projects including the ELT from 2026 until the installation on the telescope around 2031-2033. Careful selection of a person will ensure early access to new unique facilities and maximize the international impact of our research. |

### Initiatives to recruit and retain top researchers/teachers

**Instructions**: Describe:

* How the program defines what a top researcher/teacher is and how that is used in recruiting (criteria, descriptions, search groups, subject representative, addressing younger recruits who have the potential to become top, etc.),
* How the program balances recruiting external talent vs. promoting internal staff, and who is involved in these discussions and decisions,
* How gender and career stage balance is considered in program planning and recruitment decisions, and,
* What the program does to identify and encourage strong external recruits to join.

Motivation: Provide details as to what efforts are made to recruit and retain the best staff.

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| Initiating a recruitment, one needs to identify the profile or profiles of suitable candidates leaving certain flexibility to accommodate possible changes in research direction. Possible candidates with an established list of merits in research and teaching tend to be more senior people, often not very motivated and ambitious. Younger candidates usually have plenty of ambitions but may lack the experience. Thus, a balance needs to be found but formulating the requirements suitable for both categories, using advice from (external) search group. It is also useful to explore possible synergies with the Theoretical program. Internal candidates should be treated equally with external ones. |

## Career support

### Career support activities for non-tenure-track staff (beyond standard employee dialogs)

**Instructions**: Describe the activities for supporting non-tenure-track (PhDs, postdocs, researchers, adjuncts, etc.) staff in their careers and development. For example: financial support for personal development, mentoring, grant assistance, feedback, career planning, help with job searches, etc. Explicitly address what support is provided for obtaining the docent and distinguished teacher qualifications for post-PhD staff. Specify if activities are informal (e.g., expected as part of advising/mentoring) or formal (e.g., part of a regular process).

Motivation: Provide details as to how the program works with career development for non-tenured staff and encourage the program to reflect on whether it is providing the right type and amount of support.

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| Career development support for non-tenure staff (PhD students, postdocs) comes in many forms including discussions on funding possibilities, encouragement to participate in international networks, providing recommendation letters etc. These activities are mostly informal and typically take place within smaller research groups rather than at the program level. Another aspect is pedagogical training and participation in teaching. On the research side we encourage and help young scientists in applying for observations at world-leading observatories, help with data reduction and analysis and stimulate timely publications.  |

### Career support activities for tenure-track staff (beyond standard employee dialogs)

**Instructions**: Describe the activities for supporting tenure-track staff (Assistant Professors) in their careers and development. For example: financial support for personal development, startup packages, mentoring, grant assistance, feedback, career planning, co-advising, etc. Include discussions of support for promotion (Assistant to Associate) as well as docent and distinguished teacher qualifications. Specify if activities are informal (e.g., expected as part of advising/mentoring) or formal (e.g., part of a regular process). If there are very few staff in this category, please reflect on why that is and if that is something that should be addressed.

Motivation: Provide details as to how the program works with career development for tenure-track staff and encourage the program to reflect on whether it is providing the right type and amount of support.

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| Currently the program does not have any person in this category. On a previous occasion we did follow both pedagogical and research development closely so that by the end of the tenure track we have a fully qualified and integrated member of the program. |

### Career support activities for tenured staff (beyond standard employee dialogs)

**Instructions**: Describe the activities for supporting tenured staff (Associate Professors and Professors) in their careers and development. For example: financial support for personal development, mentoring, grant assistance, feedback, career planning. Include discussions of support for promotion (Associate to Professor) as well as docent and distinguished teacher qualifications. Specify if activities are informal (e.g., expected as part of advising/mentoring) or formal (e.g., part of a regular process).

Motivation: Provide details as to how the program works with career development for tenured staff and encourage the program to reflect on whether it is providing the right type and amount of support.

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| --- |
| This work is mostly related to helping with external grant application (information and support), joining large international collaborations, such as Gaia, 4MOST, ELT instrumentation Plato etc. On the career side we encourage people to proceed with docent qualification, actively supervise student projects and PhD students (even as 2nd supervisor). Scientists with sufficient qualifications are recommended for professor promotion. Considering active cooperation between the two astronomy programs, such activities are often happening at the level of the division rather than a single program. |

## Reflections on what is working well

**Instructions**: From the above, reflect on what is working well and should be continued over the next 5 years.

Motivation: Require programs to identify where current activities are successful. This will provide the panel with insights into our own self-assessment.

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| We like the working environment within the program, people collaborating with each other, sharing their results in various types of meeting from formal seminars to informal Friday meeting and astropub. We also like to have a clear focus on “data first” keeping our expertise in what is possible and what not with modern observational techniques and instruments. Proximity to the theory and space physics programs opens a few possibilities for helpful interactions from discussions of data interpretation to numerical and computational methods, atomic and molecular data etc. |

## Reflections on what needs to be improved

**Instructions**: From the above, reflect on what needs to be improved over the next 5 years. Please focus on areas that need improvement and do not list areas that could be improved but where it is not needed.

Motivation: Require programs to identify where they feel that they need to invest. This will both provide the panels with insights into our own self-assessment as well as help us improve.

|  |
| --- |
| There are many aspects where significant improvements can be achieved. The most important is the information for young researchers. It would be great to have a concise and up-to-date description of the University rules and regulations relevant to each category of research staff that covers research, teaching, and career opportunities. All this information is, of course, available at the UU web pages but finding relevant documents is not easy, especially for someone who is new to the system. Another aspect is learning from peers. This should go beyond program and division borders and the Department should encourage and support interaction between young scientists.On the research side we should motivate scientist to take on lead roles in science projects, including small and large international collaborations. |

# Area 3: Collaboration and Outreach (evaluation of processes)

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

Collaboration and outreach (“samverkan” in Swedish) should be interpreted to mean activities that reach outside of the university to non-academic partners. Specifically, academic collaborations with other research organizations within academia should be considered part of our research and not collaboration and outreach for this evaluation. To help with this section, here is a partial list of the types of collaboration and outreach that we are striving to achieve:

* Joint research projects, student/PhD/postdoc/researcher/faculty exchanges/sabbaticals, etc.
* Advising/consulting, spreading research results/insights, popular science outreach and publications, press interviews, expert panels, etc.
* Interactions with industry, government, schools, society, media, etc.
* Academic entrepreneurship, including creating, joining, and advising startups and companies, etc.
* Feedback of external ideas, challenges, relevant questions, etc., into program(s) or departments.

## Specific collaboration and outreach examples

**Instructions**: Provide up to three specific examples of collaboration and outreach activities connected to the program’s research. Under “Example and connection” describe the activity and person or organization with whom the collaboration or outreach took place. (e.g., “Expert advice on SUBJECT for COMPANY”, “Popular science book on SUBJECT aimed at AUDENICE”, or “Interview on PROGRAM about SUBJECT”.) Specify the value to the program (e.g., “exposure to new challenges and issues that COMPANY experience on a practical level” or “making the SUBJECT expertise of our researchers visible to the nation”) and the value to the partner (e.g., “insight into how COMPANY can model the physical properties from the chemical composition” or “addressing public concern over the impact of SUBJECT on the environment”). Keep in mind the broad range of collaboration and outreach listed above.

Motivation: Provide a list of specific examples of collaboration and outreach activities to motivate the self-reflection below and to serve as a source of examples for others.

|  |  |  |
| --- | --- | --- |
| 1 | Example and connection | Telescope viewings/tours (Westerlund at Ångströmlaboratoriet; Old Observatory Park; Kvistaberg Observatory) for students and the general public |
| Value to the program | Maintaining generational knowledge of telescope purpose and functionality; opportunity to underline importance of newer technology/modern observatory (e.g. VLT); student recruitment |
| Value to the partner | Access to expertise of site (i.e. telescope purpose, how it works, historical discoveries, etc), which adds to city’s cultural heritage; contextualizes UU research by comparison of resource to e.g. VLT |
| 2 | Example and connection | Participation in city/nation-wide events with other disciplines e.g. Astronomins Dag & Natt, SciFest, lecture series such as “13x13”, “Klimat & fysik för nyfikna”, and other public lectures |
| Value to the program | Student recruitment; places own research in context of other scientific disciplines (e.g. astrobiology) + industries (e.g. space/materials industry); improves science communication skill |
| Value to the partner | Appreciation of impact of UU research both within + beyond realm of astronomy due to interdisciplinary nature; excitement encourages public support for future funding (e.g. ESA/ESO) |
| 3 | Example and connection | Media appearances on nation-wide level (SVT, TV4, UR, Sveriges Radio, etc) on both UU research but also misc. space news e.g. solar winds, ESA launches/missions, light pollution, asteroids, etc  |
| Value to the program | Establishes trust in UU as serious institute by being seen as de-facto specialists of the nation on all of astronomy; provides media training for UU participants; contextualizes purpose of research |
| Value to the partner | Addresses public concerns over wide range of space-related topics e.g. space safety, in-orbit junk, sustainability; educates public on our work + these otherwise potentially unknown hazards |

### Reflections on overall aims and strategies for collaboration and outreach

**Instructions**: Use the above examples, as appropriate, to reflect on the program’s overall aims and strategies for collaboration and outreach and discuss what enabled the above examples (e.g., how were they first identified and initiated? How did they fit into the overall aims and strategies? etc.) and what it takes to keep them functioning well (e.g., staff, networking, meetings, equipment/labs/supplies, etc.).

Motivation: Understand what we need to create and maintain collaboration and outreach

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| There is a positive feedback loop that enables continued successful outreach: by us participating in opportunities (and delivering at high quality), our program’s visibility and reputation improves, which welcomes more invitations for continued participation. In order to maintain and hopefully grow our access to these opportunities, we must continue to participate enthusiastically whenever possible. This will be possible by ensuring our program retains staff with good communication/pedagogical skills who are both willing and able to dedicate a notable percentage of their time and energy to this goal. |

## Support for outreach and collaboration

**Instructions**: Describe the specific support resources and processes available to program members for outreach and collaboration towards non-academic actors, such as collegial discussions, meetings with external actors, etc. Describe whether the activities are formal or informal and whether they are managed by the research program, department, or faculty.

Motivation: Understand what support the program has for outreach and collaboration.

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| --- |
| Support is mostly internal from within the program, with additional external support available from the central university/institute when needed. Most outreach opportunities come directly to the participant in question (e.g. personalized invites to lecture for an event) but will also be circulated internally in case of a need to find volunteers. Many staff members are involved with misc. non-profit organizations/societies (e.g. Swedish Astronomical Society) that provide many such opportunities. With our past and current successes, there has historically been no need for our program to seek out outreach opportunities as invites are plentiful, and so by design there is no such support currently in place. |

## Reflections on what is working well

**Instructions**: From the above, reflect on what is working well and should be continued over the next 5 years.

Motivation: Require programs to identify where current activities are successful. This will provide the panel with insights into our own self-assessment.

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| --- |
| As of today, our program’s outreach engagement is high and therefore the number of invitations and opportunities also remains high. However, it is important to note that this is largely thanks to our current workforce’s overall culture that has bred a willingness to participate. An individual’s interest in participating in outreach varies between employees, but all contribute in some ways, from occasionally to regularly. In order to maintain our excellent momentum, it is crucial over the coming years that interest and willingness to participate in outreach is (1) identified in employees; (2) encouraged, for example by continuing to compensate for this (e.g. by contract extensions for PhD students); (3) a factor to be explicitly considered in the retention and recruitment of current and future employees. Our most successful outreach engagements are generally those that are related to what the public consider to be “exciting” projects (new telescopes + launches, or “new” areas like astrobiology and other sci-fi related concepts) and this should be considered when deciding what type of outreach activities should be prioritized re: our time and energy. |

## Reflections on what needs to be improved

**Instructions**: From the above, reflect on what needs to be improved over the next 5 years. Please focus on areas that need improvement and do not list areas that could be improved but where it is not needed.

Motivation: Require programs to identify where they feel that they need to invest. This will both provide the panels with insights into our own self-assessment as well as help us improve.

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| We feel that we are doing our share of the outreach and collaboration. Things to consider are the continuity of this work as it often relies on individual contacts and opening more opportunities for non-Swedish speaking members of the staff. |

# Area 4: Connection between Research and Teaching (evaluation of processes)

Responsibility: PAP to communicate with all program members and the director of studies, discuss, prioritize, and collate. All program members to report and discuss.

The types of connections between research and teaching that we are striving to achieve include, but are not limited to:

* Activities that lead to a scientific approach and student progression in learning how to apply the scientific method within courses and throughout education programs
* Teachers who are active researchers take opportunities to develop their pedagogical skills
* Researchers who are active teachers and take opportunities to develop their pedagogical skills
* Students being trained to find, use, and evaluate research results
* Students being active in on-going research projects
* Integration of research results, methods, and facilities in teaching

## Main teaching areas

**Instructions**: List up to four teaching programs, course packages, or contract/continuing education that the research program’s members contribute to. Specify the level (e.g., bachelor’s or master’s), how much the members of the research program contribute to the teaching program based on the number of full courses taught and whether the teaching program is managed (e.g., the program coordinator/director is in the research program) by members of the research program (yes/no). For the number of courses taught, exact values are not needed. Instead estimate the teachers’ contribution in terms of full courses taught (e.g., 1.0 means the teacher taught the equivalent of one full course) and use the ranges of: <1, 1-5, >6 to simplify accounting.

Motivation: To show what subjects the program primarily teaches in.

|  |  |  |  |
| --- | --- | --- | --- |
| Teaching program, course package, or contract/continuing education | Level | Courses Taught | Managed |
| Master's Programme in Physics – Astronomy and Space Physics | 2nd cycle | >6 | No |
| Bachelor's Programme in Physics – Astronomy | 1st cycle | 1-5 | No |
| Civilingenjörsprogram kemiteknik, molekylär bioteknik, elektroteknik, teknisk fysik | 1st cycle | 1-5 | No |
|  |  |  |  |

## Infrastructure use in teaching

**Instructions**: Please list any major research infrastructures that are used in teaching, the courses that use it, the education level, and the approximate number of students who use it each year.

Motivation: To understand what infrastructure is being used in teaching and to support the faculty’s ongoing work on developing an infrastructure policy

|  |  |  |  |
| --- | --- | --- | --- |
| Infrastructure | Courses | Level | Students |
| Westerlund telescope, ESO archive | Observational astrophysics I | 1st cycle | 6-10 |
| Sloan Digital Sky Survey database | Physics of Galaxies | 2nd cycle | 5-17 |
| SAO/NASA Astrophysics Data System | Physics of GalaxiesCosmologyPhysics of Planetary systemsPhysics of StarsAstrophysics IIAstrophysical Tests of Physical TheoriesCelestial mechanicsPlasma physics | 2nd or 1st cycle | 55 |
| ESO/NASA archives, VALD, SIMBAD database, computer cluster | Observational astrophysics II,Astrobiologi för nybörjare | 1st and 2nd cycle | 6-8, 190 |
|  |  |  |  |

## Specific teaching/research connections

**Instructions**: Provide up to four specific examples of how the program’s research has been incorporated into teaching activities or strengthened courses, and/or how teaching activities have been incorporated into the program’s research activities or strengthened the program’s research. Under “Example” describe the connection (e.g., “lab exercise using the facility X that exposes students to research technique Y”). Under “Course Info” specify the course name, program, level (introduction/advanced), and the approximate number of students taking it each year. Describe the value to the teaching experience from the research connection (or vice versa).

Motivation: Provide a list of specific examples of teaching/research connections to motivate the self-reflection below and to serve as a source of examples for others.

|  |  |  |
| --- | --- | --- |
| 1 | Example | Observations using the Westerlund telescope. |
| Course Info | Observational astrophysics I, BSc program in physics (astronomy track), first cycle, 6-10 students |
| Value to teaching/research | Provides students with hands-on experience of optical imaging and photometry, as well as the use of alt-azimuthal telescope and modern detector, which is considered very valuable for a career within observational astronomy/astrophysics. |
| 2 | Example | Tabletop games aimed at teaching students about observational strategies in observational astronomy. |
| Course Info | Physics of galaxies, MSc program in physics (astronomy track), second cycle, 5-17 studentsCosmology, MSc program in second cycle, 15-23 students |
| Value to teaching/research | Game-based learning exercises (development financed by a pedagogical development grant awarded to member of the program) that exposes the students to a combination of real astronomical data and realistic mock data relevant from our research fields. Through these games, students learn how to develop suitable observational strategies (combinations of several data sets, sensible use of telescopes) required to crack unsolved puzzles in observational astronomy. |
| 3 | Example | Case-based learning exercise involving realistic data and taxing questions in research ethics. |
| Course Info | Physics of galaxies, MSc program in physics, second cycle, 5-17 students. |
| Value to teaching/research | Exposes the students to realistic research situation, in which students are subjected to realistic mock data that suggests a record-breaking discovery, and where the students must decide on whether or not to submit their discovery for publication to Nature. |
| 4 | Example | Gearing MSc thesis projects to ongoing research to allow students to become co-authors of research papers. |
| Course Info | Degree project E in Physics and Astronomy, 30/45 credits, second cycle, 2-5 students. |
| Value to teaching/research | Gives student experience of real research and hands-on experience of the publication process. Examples from recent years include co-authorship of student Aron Kordt in papers by D’Odorico et al. (2024, Experimental astronomy submitted, arXiv arXiv:2311.16803), students Emma Lundqvist, Adam Hultquist and Aron Kordt in Zackrisson et al. (2024, MNRAS, submitted, arXiv 2312.09289), student Weihui Li in Nabizadeh et al. (2024, A&A, in press, arXiv2308.07260), student Emma Fransson in Vikaeus et al. 2022 (MNRAS, 512, 2030). |

### Reflections on overall aims and strategies for connections

**Instructions**: Use the above examples, as appropriate, to reflect on the program’s overall aims and strategies for teaching and research connections and discuss what enabled the above examples (e.g., How were they first identified and initiated? How did they fit into the overall aims and strategies? etc.) and what it takes to keep them functioning well (e.g., staff, networking, meetings, equipment/labs/supplies, etc.).

Motivation: Understand what we need to create and maintain connections

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| Several members of the research program have been able to take on roles as course coordinators within in the astronomy tracks of the Physics BSc and MSc programs (Examples of courses: Observational astrophysics I and II, Physics of Planetary Systems, Physics of Stars, Nuclear Astrophysics, Physics of Galaxies, Cosmology) which has allowed some of the course content to be geared to ongoing research. This connection is maintained through personal initiatives rather than some coordinated effort. However, the program is very supportive of teaching activities, and allows members to take pedagogical courses, develop course content and lead pedagogical development projects. |

## Support for integrating teaching and research

**Instructions**: Describe the support resources and processes for integrating teaching and research available to program members such as collegial discussions, meetings with students, course reviews, teaching follow-up, etc. Describe whether the activities are formal or informal and whether they are managed by the research program, department, faculty, or teaching program. If there are no such resources or processes in the research program, then please reflect on whether that is something the research program or department should address under reflections below.

Motivation: Explain what support there is for improving the research and teaching connection.

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| Support for improving the connection between research and teaching is mainly provided at the department and faculty levels, in the form of lunch seminars on teaching, pedagogical courses and the availability of funding for pedagogical development projects. |

## Reflections on what is working well

**Instructions**: From the above, reflect on what is working well and should be continued over the next 5 years.

Motivation: Require programs to identify where current activities are successful. This will provide the panel with insights into our own self-assessment.

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| The activities listed have been in place for many years and are working very well, according both to student evaluations and the teachers involved. They are all expected to continue throughout the next 5-year period. |

## Reflections on what needs to be improved

**Instructions**: From the above, reflect on what needs to be improved over the next 5 years. Please focus on areas that need improvement and do not list areas that could be improved but where it is not needed.

Motivation: Require programs to identify where they feel that they need to invest. This will both provide the panels with insights into our own self-assessment as well as help us improve.

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| The connection between teaching and research is already considered strong within many of the more specialized astronomy/astrophysics courses in which members of our program are involved, and there is no pressing need for improvement. One of the main hands-on tools, the Westerlund telescope, is 20 years old and needs renovation, especially new electronics, new software and new detector. The total cost is estimated to about 5 MSEK. Another new direction is AI and machine learning that are quickly becoming an important part of our research, but are not yet integrated in the courses we teach. |

# 5-year Priorities

**Instructions**: Identify, describe, and motivate specific Priorities that have a high likelihood of meaningfully strengthening or meaningfully broadening research over the next 5 years. The Priorities should be well-motivated and have sufficiently developed plans that it is clear what needs to be done to accomplish them and how to evaluate if they are successful. The Priorities can cover a wide range of activities with the overall goal of strengthen research, and do not need to require additional expenses. These can include, but are not limited to:

* Strengthening existing areas (e.g., to adapt to future challenges in the field or are necessary to maintain high quality, including by investing in new equipment, facilities, or staff, etc.)
* Investing in new areas (e.g., to adapt to changes in the field or new developments, by including investing in new equipment, facilities, or staff, etc.)
* Changing research organization by splitting, merging, closing, or moving research programs/departments (e.g., to improve collaboration or use of facilities or resources, etc.)
* Changing research policies (e.g., to address funding/co-funding, multi-disciplinary work, or recruiting, etc.)
* Changing research support (e.g., to improve grant success rates, recruiting, management, adoption of new techniques/technologies, etc.)

Building upon existing strategic plans is encouraged and co-funding/support from the program or department is expected to demonstrate commitment to the plan. There will be a yearly lightweight follow up process to see what progress has been made for each Priority with an opportunity to revise/change them as needed. The goals are to both ensure that we follow up on our stated Priorities and that we always have clear Priorities at each level in the faculty.

Each program is allowed to propose 3 Priorities: one that can be fully accomplished within the program, one that may require support at the department level, and one that may require support at the faculty level. This done to ensure that all programs will have at least one Priority they can work on as the very limited faculty funding available means only a few programs will receive additional resources.

Prioritization at the department level: Each department will review the Priorities from all of its programs and consider which to include in the department’s own list of Priorities, along with department’s own Priorities.

Motivation: Identifying Priorities encourages strategic analysis and medium-term planning within the program, and makes it easier for the department and panel to understand the programs’ own assessments of their needs and opportunities. Requiring two of the Priorities to be able to be accomplished within the program and the department emphasizes the need to work locally as well as at the faculty level.

Responsibility: PAP in discussion with program members.

# Priority 1 of 3: An activity that can be accomplished within the program

## Description of the Priority

**Instructions**: Provide the department name (since these will be collected at the section/faculty level) and the program name (if this is a program Priority), the title of the Priority, and whether it may require department support (Yes/No) and/or faculty support (Yes/No).

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| Department: | IFA |
| Program: | Observational Astrophysics |
| Title: | Recruitment of BUL/UL to strengthen the program's research areas |
| Support: | May require department support: | Yes | May require faculty support: | No |

### Goal

**Instructions**: Specify the goal of the Priority, for example, to strengthen a specific existing activity or start a new one.

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| Taking world-leading positions in our specialty research areas |

### Expected meaningful research improvement

**Instructions**: Provide a description of the research that investing in this Priority will accomplish over the next 5 years. Explain how it has the potential to significantly strengthen or broaden the program for program proposals or department for department proposals. Specifically, this should go beyond continuing or slightly enlarging current activities by having a clear description of what change it will accomplish.

Motivation: The overall goal is to strengthen our research. As a result, the Priority should deliver meaningful improvements in research quality and/or breadth.

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| There are a number of areas in observational astrophysics where the program has expertise but UU is not prominently present in defining and leading research projects based on this expertise. A few examples are the science exploitation of JWST, 4MOST (public surveys), HARPS3 instrument (Terra Hunting Experiment at the Isaac Newton Telescope) and some others. This situation is simply due to lack of manpower forcing our staff to do too many things at the same time. We see the solution in form of a new recruitment that will allow everyone to be more focused and less stressed, and as a consequence more productive.Sweden is part of both ELT and SKA projects and the program is deeply involved in building ELT instruments. Given that we fulfil our obligations UU is guaranteed early access to the new instruments and observational data, which means that this priority is mutually beneficial with the priority described in Section 9. |

### Implementation plan

**Instructions**: Provide a brief description of specifically what is planned to be done over the next 5 years to realize the potential of this Priority. For example: new hires, investments in equipment, starting collaborations, closing down existing activities, moving resources from existing activities, etc. Use the limited space provided here to discuss the most important aspects of how this activity will be carried out.

Motivation: For a Priority to be credible, there must be a plausible plan and what needs to be accomplished must have been thought through. It is understood that these plans will change over the next 5 years, however.

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| The proposed solution is to recruit a new BUL/UL in 2027-2028, following the arrival of the new UL (2024) and the replacement of the current PaP (2026). The recruitment should identify prospective areas of research at the interfaces of existing research not adequately covered, take initiative in these specific areas and lead the progress in one-two of these areas internationally. The list of areas includes multi-messenger astronomy involving active inter-program (or Unit) collaboration with the Astroparticle group, support and development of our local infrastructures used nationally and internationally (VALD and MARCS databases, together with the Theory program, SME spectral synthesis tool, REDUCE echelle data reduction tool box etc.), and the preparation for the new possibilities on a longer time scale (ELT and SKA). Such recruitment will require a financial support in the form of an additional 0.6 FFF added to the program budget. |

### What previous accomplishments indicate a high likelihood of success?

**Instructions**: Describe what recent (last 5 years) accomplishments make it clear that the there is a good chance of success in this project. Use specific examples (e.g., grant X, collaboration Y, paper Z) and explain how those recent accomplishments are evidence of having the competencies needed to be successful in this project.

Motivation: For a Priority to be credible, the expertise and track record needed to support it must be present.

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| Multi-messenger astronomy: we build a solid expertise working on large-scale surveys (Gaia, Gaia-ESO, 4MOST).Local infrastructure: VALD and MARCS databases are used world-wide by thousands of people. Our software packages SME and REDUCE are used by hundreds of groups for science and education. They have recently been translated to Python and gain new features.Sweden is part of both ELT and SKA projects and the program is deeply involved in building ELT instruments. |

## Current status of the area at Uppsala University

Instruction: Describe the current status of the area at Uppsala University as a whole. Include any existing funding, support, staff, and success in this area. Explicitly identify any overlap with other existing activities at the program(s), department, section, faculty, and/or university levels.

Motivation: To avoid duplicating efforts, it is important to understand the local Uppsala context when enhancing existing activities or starting new efforts. As part of the evaluation process, the panel will try to identify synergies between proposed Priorities.

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| People involved in surveys (2 UL) are quite interested in combined their findings with the astroparticle research (IceCube) and, potentially, with gravitational wave experiments. VALD, SME and REDUCE maintenance and development are done by three people who can afford only 5% of their time to this work. |

### Current and planned contributions to support the initiative

**Instructions**: Describe the current (already in-place and on-going) and planned contributions to this goal from the local level (from the program for program proposals, from the department for department proposals, and from both the program(s) and department, as appropriate, for program proposals selected by the department). For example, co-funding, in-kind support, shared funding of facilities, transfers of FFFs, etc.

Motivation: Evidence of financial commitment from the local environment strongly supports the proposal as being important. Conversely, if the local environment is unable or unwilling to support it, the importance to the environment as a whole is much weaker.

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| Depending to the way the PaP replacing will go the program will use the newly available resources to support this recruitment, but it is clear that such resources amount to no more than 50% of UL and less if the PaP will be replaced with external recruitment. |

## Strategic value

### Strategic value of the area in the global context

Instruction: Describe the importance of the area in the global context. For example: fundamental challenges in research; new developments in research; societal challenges and priorities; global impact and importance.

Motivation: To ensure consideration of the larger context.

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| The focus of this initiative is to complement and raise the existing expertise within the program to international visibility and scientific leadership reflected, e.g. by 1st author publications, international project PI positions etc. |

### Strategic value of the area at the next level

Instruction: Describe the importance of the area to the department (for program proposals) and for the section and faculty (for department proposals). For example: synergies with other activities, connections to teaching and collaboration, both currently and potential for new ones, etc. Explain the value of this activity beyond any overlapping ones identified above.

Motivation: To ensure that there is awareness of where this activity fits in at the next level up in the organization. This is particularly important if support is to be requested at that level.

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| International visibility will be directly projected on the Department and Faculty. E.g. already now UU IFA is known as an instrument development center and not only for accelerators and material sciences. Cross-discipline collaborations are naturally included in this proposal. |

## Contributions needed for success

**Instructions**: Identify what contributions are needed for success in terms of time, expertise, resources, facilities, staff, etc. Explicitly include estimates of financial resources needed and where they will come from.

Motivation: To ensure the costs and resources required have been thought through, and that they are reasonable given the scope of the benefit.

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| The program is doing quite well with external funding helping us maintain PhD and postdoc positions. Thus, the main point is to be able to afford another UL while not increasing the number of research areas. This will bring balance in our work.  |

### Success indicators

**Instructions**: Describe specific results that will indicate success in 5 years. For example: increases in publications in top venues X and Y, publications in new field Z, strengthened or new collaborations with university A, new hires in B, new grants from C, etc.

Motivation: To ensure that the local- and faculty-levels will be able to assess whether this Priority was successful at the next evaluation so that we develop a positive cycle of following up on our strategic planning.

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| The number of 1st author papers in various international projects involving infrastructure development and scientific usage. |

### First steps that can be taken today

**Instructions**: Describe the first concrete steps needed to move in this direction that can be taken today. These should be clear enough that they can be followed up on in a year to see what progress has been made. Identify initial activities that can be started locally to enable progress to help motivate further support for the larger goal. In the exceptional case where no steps can be taken today, explain why a Priority has been chosen that cannot be started.

Motivation: To ensure that there is a clear idea of how to get started and enable easy follow-up of how the Priority is progressing.

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| Internal discussion of staff interests and future plans. Discussions with the Theory program and new recruits about changes that we expect/would like to see. Discussions with the advisory group established for the PaP replacement.  |

# Priority 2 of 3: An activity that may require department support

## Description of the Priority

**Instructions**: Provide the department name (since these will be collected at the section/faculty level) and the program name (if this is a program Priority), the title of the Priority, and whether it may require department support (Yes/No) and/or faculty support (Yes/No).

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| Department: | IFA |
| Program: | Observational astrophysics |
| Title: | Recruitment of UL/Professor to lead instrumentation development projects. |
| Support: | May require department support: | Yes | May require faculty support: | Yes |

### Goal

**Instructions**: Specify the goal of the Priority, for example, to strengthen a specific existing activity or start a new one.

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| Completing UU infrastructure development commitments and shifting toward scientific use of the ELT and other facilities. |

### Expected meaningful research improvement

**Instructions**: Provide a description of the research that investing in this Priority will accomplish over the next 5 years. Explain how it has the potential to significantly strengthen or broaden the program for program proposals or department for department proposals. Specifically, this should go beyond continuing or slightly enlarging current activities by having a clear description of what change it will accomplish.

Motivation: The overall goal is to strengthen our research. As a result, the Priority should deliver meaningful improvements in research quality and/or breadth.

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| The ESO Extremely Large Telescope (ELT) will become operational with the full set of instruments by 2032-2035. UU is a major contributor to 3 out of 5 instruments, which will grant UU astronomers early access to this unique facility. The capabilities of the ELT and its instruments go orders of magnitude beyond what is possible today. Examples: direct search for biosignatures on exoplanets and unbiased measurements of the expansion of the Universe. Our commitments range from the development of the fiber optics system to data reduction and scientific analysis pipelines. Today they are all coordinated by the Observational Astrophysics PaP, who is retiring at the end of 2026. By this time the instrument construction will be well on the way and so the main task of the new coordinator will be to complete the construction and start using the new facilities in our research. The ELT will have no competition for many years to come and the access to the observing time will be very limited, so for UU it is a unique opportunity for leading our research fields (such as exoplanets, history of our galaxy, stellar magnetic fields, first stars and first galaxies) internationally. |

### Implementation plan

**Instructions**: Provide a brief description of specifically what is planned to be done over the next 5 years to realize the potential of this Priority. For example: new hires, investments in equipment, starting collaborations, closing down existing activities, moving resources from existing activities, etc. Use the limited space provided here to discuss the most important aspects of how this activity will be carried out.

Motivation: For a Priority to be credible, there must be a plausible plan and what needs to be accomplished must have been thought through. It is understood that these plans will change over the next 5 years, however.

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| Planning for the transition of responsibilities both within the program but also withing the instrument consortia and with ESO takes time and efforts. We will formulate the requirements for the position carefully and in this we will use help from an external advisory group. We will identify potential candidates externally and internally with a preference to younger, fast progressing researchers. The goal is to announce the position in the middle of 2025 and have the (new) person gradually taking responsibilities for instrumentation projects in 2026-2027. Around 2027 the successful candidate should start working with all researchers in all research areas in the Astronomy and Space Physics programs on preparation of the observing proposals for the ELT. The new recruitment should have a UL or (better) professor status to be able to represent UU in project boards on equal footing. She/he will also need a serious technical and management support as the Swedish contribution to the ELT instrumentation is at the level of 70 MSEK (funded by the RFI) and these must be properly used. Thus, an additional (postdoc) position is needed. |

### What previous accomplishments indicate a high likelihood of success?

**Instructions**: Describe what recent (last 5 years) accomplishments make it clear that the there is a good chance of success in this project. Use specific examples (e.g., grant X, collaboration Y, paper Z) and explain how those recent accomplishments are evidence of having the competencies needed to be successful in this project.

Motivation: For a Priority to be credible, the expertise and track record needed to support it must be present.

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| Instrument development is challenging, especially within large collaborations and when the instruments are getting progressively more complex. UU has a good track record of designing and building instruments for ESO (HARPSpol, CRIRES+). HARPSpol is a polarimetric unit on the HARPS spectrometer. It was completed in 2010 and produced over 200 refereed publications. CRIRES+ is new infrared spectrometer completed in 2020. UU received a 35 MSEK grant from the KAW foundation. The instrument generated over 330 refereed publications since including 11 by UU astronomers. We do have funding for the current work on the ELT and this project is at the top of the national infrastructure priority list so it will likely be funded in the future.  |

## Current status of the area at Uppsala University

Instruction: Describe the current status of the area at Uppsala University as a whole. Include any existing funding, support, staff, and success in this area. Explicitly identify any overlap with other existing activities at the program(s), department, section, faculty, and/or university levels.

Motivation: To avoid duplicating efforts, it is important to understand the local Uppsala context when enhancing existing activities or starting new efforts. As part of the evaluation process, the panel will try to identify synergies between proposed Priorities.

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| The current PaP is a co-PI on one ELT instrument ANDES. The UU team is responsible for key components or work packages in METIS, ANDES (fiber optics) and MOSAIC. The data reduction pipeline design in all three instruments is based on UU software. We are also contributing to data analysis system.  |

### Current and planned contributions to support the initiative

**Instructions**: Describe the current (already in-place and on-going) and planned contributions to this goal from the local level (from the program for program proposals, from the department for department proposals, and from both the program(s) and department, as appropriate, for program proposals selected by the department). For example, co-funding, in-kind support, shared funding of facilities, transfers of FFFs, etc.

Motivation: Evidence of financial commitment from the local environment strongly supports the proposal as being important. Conversely, if the local environment is unable or unwilling to support it, the importance to the environment as a whole is much weaker.

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| With 3 people fully dedicated to instrumentation projects we get VR support from RFI that is funding the development of ANDES and MOSAIC. At the program level we provide additional manpower and fund the support of METIS activities. The IFA workshop is a crucial component of local infrastructure. |

## Strategic value

### Strategic value of the area in the global context

Instruction: Describe the importance of the area in the global context. For example: fundamental challenges in research; new developments in research; societal challenges and priorities; global impact and importance.

Motivation: To ensure consideration of the larger context.

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| ELT is qualitatively new and unique. It can reach science goals that are simply unfeasible today. E.g. we expect to be able to study habitability of Earth-like exoplanets. Massive progress is expected in nearly all fields but the telescope is unique and getting observation time will be a challenge. |

### Strategic value of the area at the next level

Instruction: Describe the importance of the area to the department (for program proposals) and for the section and faculty (for department proposals). For example: synergies with other activities, connections to teaching and collaboration, both currently and potential for new ones, etc. Explain the value of this activity beyond any overlapping ones identified above.

Motivation: To ensure that there is awareness of where this activity fits in at the next level up in the organization. This is particularly important if support is to be requested at that level.

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| As the builders of instruments for the ELT we will have priority access to the observing time. This is a unique opportunity to participate and lead major breakthroughs in our areas of research. We just have to use this chance properly by being sufficiently staffed. |

## Contributions needed for success

**Instructions**: Identify what contributions are needed for success in terms of time, expertise, resources, facilities, staff, etc. Explicitly include estimates of financial resources needed and where they will come from.

Motivation: To ensure the costs and resources required have been thought through, and that they are reasonable given the scope of the benefit.

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| To complete the development and construction of the ELT instruments we need competent people familiar with state-of-the-art astronomical instrumentation. The extra budget is estimated to be 30 MSEK and will be provided by RFI. We need affordable access to our workshop for prototyping and manufacturing. |

### Success indicators

**Instructions**: Describe specific results that will indicate success in 5 years. For example: increases in publications in top venues X and Y, publications in new field Z, strengthened or new collaborations with university A, new hires in B, new grants from C, etc.

Motivation: To ensure that the local- and faculty-levels will be able to assess whether this Priority was successful at the next evaluation so that we develop a positive cycle of following up on our strategic planning.

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| Recruiting the replacement for the current project coordinator (2026), completing and testing the prototype for the fiber optics system of ANDES (2026), delivering the data reduction pipeline for METIS (2027) and for ANDES (2028). Acceptance of observing proposals at the ELT after 2029. |

### First steps that can be taken today

**Instructions**: Describe the first concrete steps needed to move in this direction that can be taken today. These should be clear enough that they can be followed up on in a year to see what progress has been made. Identify initial activities that can be started locally to enable progress to help motivate further support for the larger goal. In the exceptional case where no steps can be taken today, explain why a Priority has been chosen that cannot be started.

Motivation: To ensure that there is a clear idea of how to get started and enable easy follow-up of how the Priority is progressing.

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| Setting up an external advisory group for recruitment (in progress). Compiling specifications and assessing optical design for the fiber link of ANDES (in progress). Preparing call for tender for the fiber optics slit unit (end of 2024). Formulating the requirements for the new recruitment and starting a search group (2025). |

# Priority 3 of 3: An activity that may require faculty support

## Description of the Priority

**Instructions**: Provide the department name (since these will be collected at the section/faculty level) and the program name (if this is a program Priority), the title of the Priority, and whether it may require department support (Yes/No) and/or faculty support (Yes/No).

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| Department: | IFA |
| Program: | Observational astrophysics |
| Title: | Cross-disciplinary center for AI and ML specialized on physics and astronomy |
| Support: | May require department support: | Yes | May require faculty support: | Yes |

### Goal

**Instructions**: Specify the goal of the Priority, for example, to strengthen a specific existing activity or start a new one.

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| Educate researchers and students in AI-based technologies and stimulate novel AI applications in physics and astronomy.  |

### Expected meaningful research improvement

**Instructions**: Provide a description of the research that investing in this Priority will accomplish over the next 5 years. Explain how it has the potential to significantly strengthen or broaden the program for program proposals or department for department proposals. Specifically, this should go beyond continuing or slightly enlarging current activities by having a clear description of what change it will accomplish.

Motivation: The overall goal is to strengthen our research. As a result, the Priority should deliver meaningful improvements in research quality and/or breadth.

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| AI and ML are making quick entrance in many aspects of our life but their use in scientific research is complicated: there are many flavors of ML tools that may potentially be used for similar purposes. The solution is to educate people that already understand the intricacies of physical problems in the properties and suitability of various ML tools and applications. On particular field that may benefit from the use of ML is large surveys that are getting more popular in observational astronomy. These produce large amounts of homogeneous data and conventional serial tools for data reduction and analysis can no longer keep up with the data flow. A departmental center providing courses and sharing application experience could be the fastest way for providing researchers with the necessary background and helping them to keep up with this useful technique. |

### Implementation plan

**Instructions**: Provide a brief description of specifically what is planned to be done over the next 5 years to realize the potential of this Priority. For example: new hires, investments in equipment, starting collaborations, closing down existing activities, moving resources from existing activities, etc. Use the limited space provided here to discuss the most important aspects of how this activity will be carried out.

Motivation: For a Priority to be credible, there must be a plausible plan and what needs to be accomplished must have been thought through. It is understood that these plans will change over the next 5 years, however.

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| The Department should collect the interest from all the programs and present a proposal for a competence center “AI for Physics”. Programs and divisions should assess their interest and ability to contribute in the form of specialists, lecturers etc. We should also consider close collaboration with IT in terms of consulting and guidance. Such a center should also be equipped with a demonstration computing facility suitable for ML work to train researchers in practical steps in ML implementation. We expect that the use of ML should be part of a standard toolbox our researchers and PhD students should master similar to other numerical methods. |

### What previous accomplishments indicate a high likelihood of success?

**Instructions**: Describe what recent (last 5 years) accomplishments make it clear that the there is a good chance of success in this project. Use specific examples (e.g., grant X, collaboration Y, paper Z) and explain how those recent accomplishments are evidence of having the competencies needed to be successful in this project.

Motivation: For a Priority to be credible, the expertise and track record needed to support it must be present.

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| There are several examples of more or less successful use of ML and AI in our research. Some of our colleagues already have some experience with ML, not the least through participation in the University program AI4Resarch.  |

## Current status of the area at Uppsala University

**Instruction**: Describe the current status of the area at Uppsala University as a whole. Include any existing funding, support, staff, and success in this area. Explicitly identify any overlap with other existing activities at the program(s), department, section, faculty, and/or university levels.

Motivation: To avoid duplicating efforts, it is important to understand the local Uppsala context when enhancing existing activities or starting new efforts. As part of the evaluation process, the panel will try to identify synergies between proposed Priorities.

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| We are starting to use ML in collaboration with our partners outside of IFA and outside of UU. An example of such collaboration is the analysis tool for the stellar spectroscopic surveys with the new 4MOST instrument that will produce 2500 spectra every 20 minutes. |

### Current and planned contributions to support the initiative

**Instructions**: Describe the current (already in-place and on-going) and planned contributions to this goal from the local level (from the program for program proposals, from the department for department proposals, and from both the program(s) and department, as appropriate, for program proposals selected by the department). For example, co-funding, in-kind support, shared funding of facilities, transfers of FFFs, etc.

Motivation: Evidence of financial commitment from the local environment strongly supports the proposal as being important. Conversely, if the local environment is unable or unwilling to support it, the importance to the environment as a whole is much weaker.

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| Both observational and theoretical programs have some people competent in ML. They are interested in contributing to the organization and operation of an AI center and we expect such contribution to be mutually beneficial. |

## Strategic value

### Strategic value of the area in the global context

**Instruction**: Describe the importance of the area in the global context. For example: fundamental challenges in research; new developments in research; societal challenges and priorities; global impact and importance.

Motivation: To ensure consideration of the larger context.

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| ML and AI hold the promise to make routine analysis tasks massively faster and simpler. In specific cases the use of these tools will make our research much more efficient while opening the possibility for serendipitous discoveries. |

### Strategic value of the area at the next level

**Instruction**: Describe the importance of the area to the department (for program proposals) and for the section and faculty (for department proposals). For example: synergies with other activities, connections to teaching and collaboration, both currently and potential for new ones, etc. Explain the value of this activity beyond any overlapping ones identified above.

Motivation: To ensure that there is awareness of where this activity fits in at the next level up in the organization. This is particularly important if support is to be requested at that level.

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| The commonality of the mathematical background, software tools and computer hardware will stimulate inter-program cooperation and interest in other field of research.  |

## Contributions needed for success

**Instructions**: Identify what contributions are needed for success in terms of time, expertise, resources, facilities, staff, etc. Explicitly include estimates of financial resources needed and where they will come from.

Motivation: To ensure the costs and resources required have been thought through, and that they are reasonable given the scope of the benefit.

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| There should be some resources to help specialists prepare and run courses and training programs. There should be resources for purchasing adequate computing equipment. There should also be resources to organize and run common seminar series. This will require help, possible at the Faculty level. |

### Success indicators

**Instructions**: Describe specific results that will indicate success in 5 years. For example: increases in publications in top venues X and Y, publications in new field Z, strengthened or new collaborations with university A, new hires in B, new grants from C, etc.

Motivation: To ensure that the local- and faculty-levels will be able to assess whether this Priority was successful at the next evaluation so that we develop a positive cycle of following up on our strategic planning.

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| Number of students (including staff) attending AI and ML courses. Number of publications with acknowledgement to the Center. Visibility of the Center through presentations at specialized AI/ML national and international conferences. |

### First steps that can be taken today

**Instructions**: Describe the first concrete steps needed to move in this direction that can be taken today. These should be clear enough that they can be followed up on in a year to see what progress has been made. Identify initial activities that can be started locally to enable progress to help motivate further support for the larger goal. In the exceptional case where no steps can be taken today, explain why a Priority has been chosen that cannot be started.

Motivation: To ensure that there is a clear idea of how to get started and enable easy follow-up of how the Priority is progressing.

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| Identification of interest from IFA programs and identification of people interested in contributing to the Center.  |

# Questions to the panel

The panel will provide feedback on research quality, strengths and opportunities for improvement, and comment and give feedback on staffing, funding, and at least one priority area.

**Instructions**: If you have specific questions for the panel that are not covered by those areas, please list up to three of them here. Please note that due to time constraints during the visit, not all questions may be answered.

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| (approximately 600 characters)Question 1:Question 2:Question 3: |