KoF/ÖB 2024

Faculty of Science and Technology

Research Program Self-Evaluation

|  |  |
| --- | --- |
| Research Program: | Materials Physics |
| Department: | Department of Physics and Astronomy |
| Section: | Physics |
| Program Responsible Professor: | Björgvin Hjörvarsson (until March 2024)  Daniel Primetzhofer nominated April 2024 |

|  |
| --- |
| **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 |

**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.

|  |
| --- |
| Main work was done by all faculty staff, including prospective new program professor (PAP) from ion physics group, due to the ongoing merging process where ion physics will join the program. Retiring PAP gave some support. Postdocs, PhD students got opportunity to comment prior to submission. |

## 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.

|  |
| --- |
| Understanding emergent physics of materials, their structure and composition across multiple length scales from atomic to macroscopic, linking to functional properties. Core areas are magnetism, hydrogen in metals, soft and engineering materials. Expertise in synthesis, characterization and instrumentation. |

## 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 | 0.5 |  | 1.3 | 6.4 |  | 0.5 |  |  | 6.9 |
| **Male** | 2.8 | 0.7 | 0.5 | 4.0 | 3.3 | (+2.8) | 1.8 |  | 0.5 | 5.5 |

## 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.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **FFF+SFO Internal Research** | **Other Internal Research** | **Total Internal Research** | **External Research** | **Total Research** | **External Research %** |
| **2023** | 5.8 | 2.2 | 8.0 | 14.9 | 22.9 | 65% |
| **2022** | 5.6 | 1.6 | 7.3 | 12.6 | 19.9 | 63% |
| **Average** | 5.7 | 1.9 | 7.6 | 13.8 | 21.4 | 64% |

### 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.

|  |
| --- |
| Starting package for BUL & UL, PhD education (studiestöd), department infrastructure funding, short-term faculty funding for prospecting a Swedish compact neutron source. |

### 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.

|  |
| --- |
| Faculty on all levels are paid by teaching (to a smaller extent than the actual teaching time, due to deficient teaching funding to the faculty) and FFFs; some partially from external grants (infrastructure operation mainly, less on project grants). Non-tenure staff sometimes teach a little, otherwise on external grants. Startup packages for new faculty come from department. Postdocs are mainly on scholarships, PhDs mainly on external grants and teaching. Studiestöd is used as buffer funding of PhDs to reach full 4 years. Considerable internal resources go into maintenance of labs and co-funding. We operate the VR infrastructure SuperADAM. |

### 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.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Faculty Salary | Non-Faculty Salary | Other Personnel Costs | Premises | Equipment Depreciation | Overhead | Running Costs | Total |
| 2023 | 3.5 (37%) | 2.8 (30%) | 0.1 (1%) | 0.3 (4%) | 0.4 (4%) | 1.9 (20%) | 0.4 (4%) | 9.4 |
| 2022 | 3.2 (38%) | 2.6 (31%) | 0 (0%) | 0.3 (3%) | 0.5 (6%) | 1.6 (19%) | 0.2 (3%) | 8.3 |
| Average | 3.3 (38%) | 2.7 (30%) | 0.1 (1%) | 0.3 (3%) | 0.4 (5%) | 1.7 (20%) | 0.3 (3%) | 8.9 |

### 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.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Female | | | Male | | |
|  | Internal | External | Teaching | Internal | External | Teaching |
| Professor | 73% | 0% | 28% | 61% | 21% | 18% |
| Associate (UL) | 30% | 20% | 50% | 38% | 34% | 28% |
| Assistant (BUL) |  |  |  | 41% | 20% | 39% |
| PhD | 37% | 57% | 6% | 8% | 84% | 9% |
| Postdoc |  |  |  |  |  |  |
| Researcher | 30% | 20% | 50% | 42% | 57% | 1% |

### 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.

|  |  |  |  |
| --- | --- | --- | --- |
| Infrastructure | Sharing | Location | Approximate Yearly Cost (MSEK) |
| Super ADAM (ILL activity in general, national/international user facility), the program is responsible for every aspect of this infrastructure | national + international | ILL (Grenoble, France) | VR |
| Material growth, synthesis and structure characterization infrastructure (3 PVD systems & 5 XRD machines) | Program + uni + collab. | materials physics | 3.5 |
| Materials characterization (magnetism, hydrogen, optical, electrical transport, scanning probe microscopy) | Program + uni + collab | Materials physics | 2 |
| MyFab & AM@Å for materials processing (national, AM@Å under development as hub within WISE) Member of boards | Uni + national | Ångströmlab | >0.5 |
| Tandem laboratory (national user facility) After merger scientific leadership | National + international | Ångströmlab | VR + user fees |

## 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.

|  |
| --- |
| Table 1.3: 2.8 stipend postdocs added. One prof had a time-limited task from the faculty for prospecting of a Swedish compact neutron source. All centrally provided data are for the materials physics program only, prior to the merger with ion physics initiated 2024. |

# 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.

|  |
| --- |
| The goals set out in ÖB19 regarding problem-oriented research and methods have largely been met, which highlight their original feasibility and the great recent success of the program. The program has undergone organic and highly successful renewal since 2017 in terms of new areas of inquiry. The goal of improved engagement and outreach among staff as highlighted in ÖB19 is in continual development and can be considered as adequate. The output in this regard is hampered by limited dedicated funds for this activity. |

# 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.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Main Research Areas [\*: *before(after) ongoing merger with ion physics*] | | % of program | FTE Faculty | Type |
| 1 | Metamaterials (incl. thin films, metallic glass, optics nanostructures) | 31(29) \* | 1.4(2.2) \* | mixed |
| 2 | Magnetism | 33(21) \* | 1.2(1.4) \* | mixed |
| 3 | Hydrogen in materials | 18(15) \* | 0.7(0.9) \* | mixed |
| 4 | Soft matter | 15(10) \* | 0.4(0.4) \* | mixed |

## 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.

|  |
| --- |
| The common denominator is the design of new materials to meet upcoming challenges of societal relevance. Innovative and disruptive materials proposals require understanding of the underlying physics.  \* METAMATERIALS, overlapping with MAGNETISM: Synthesis and fabrication exploiting thin film heterostructures, clean room facilities, ion beam techniques and additive manufacturing approaches. Resulting metamaterials are studied with respect to their magnetic order and dynamics, coupling to light, mechanical properties and modification of bulk magnetic properties. Connections to multi-functionality are under strong focus, coupling between e.g. light and magnetism (magneto-optics, light driven magnetization dynamics), sensing etc.  \* AMORPHOUS MAGNETISM: Understanding and engineering anisotropy in amorphous metallic thin films and multilayers. Using ion implantation to create mesoscale changes in composition for tailoring the magnetic properties. Additive manufacturing for creating soft-magnetic parts for e.g. energy conversion.  \* HYDROGEN IN MATERIALS: contributing to improving the speed and uptake of solid-state hydrogen storage, understanding and avoiding hydrogen-induced embrittlement, and topics of relevance to purification membranes and hydrogen sensors. The approach is focused on thin films as model systems and specifically address metallic glasses to understand and tune the short- and medium-range order to achieve superior performance for the hydrogen economy.  \* SOFT MATTER: Understanding of viscoelasticity – macroscopic flow instabilities – molecular structure and dynamics-topological interactions under flow (higher risk). Self-assembly of meso-scale as well as colloidal and polymer systems. Magnetic self-assembly.  \* NEUTRON SCATTERING: Operation and renewal of SuperADAM at ILL, which is highly beneficial for all four areas above. Design of a surface scattering beamline (SAGA) for ESS. Planning of a compact accelerator-driven local neutron source. |

## 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.

|  |
| --- |
| Dynamics, magnetophotonics and ultrafast optomagnetism in magnetic metamaterials. Quantum effects in magnetic epitaxial heterostructures (e.g. Fe/MgO). Collaborations at department, where our expertise in magnetic characterization is complemented by colleagues’ expertise in patterning (e.g. ultralow magnetostrictive flexible ferromagnetic nanowires). Open source scattering simulation tools for epitaxial films, made available globally. Using ion implantation to create magnetic mesostructures by small local variations of composition in amorphous films. Hydrogen-induced volume changes, dipole tensor, and elastic hydrogen-hydrogen interaction in a metallic glass. AM of single-crystal steel. Extensive efforts on method development within neutron scattering techniques relevant for investigations of soft matter and solid-liquid interfaces, i.e. grazing incidence, off-specular, and small-angle scattering. Several reviews and published lecture notes on this, written in European and global collaborations. |

### 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 | 224 / 79 |
| Proportion of publication fractions at the Norwegian model level 2 (%) | Impact | 28% |
|  |  | 2017-2021 |
| Coverage (fractionalized): Proportion of publications from DiVA included in citation statistics, weighted by fractional counts | Coverage | 86% |
| Mean normalized number of citations per publication (MNCS) | Impact | 0.73 |
| Proportion of frequently cited publications (top 10%) (PP(top 10%)) | Impact | 5% |

### 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.

|  |  |  |
| --- | --- | --- |
| Channel | Number | % of Total Publications |
| Physical Review B: Condensed Matter and Materials Physics | 22 | 9.8 |
| Scientific Reports | 12 | 5.4 |
| Physical Review Materials | 9 | 4.0 |
| Journal of Alloys and Compounds | 6 | 2.7 |
| Journal of Applied Physics | 6 | 2.7 |
| Journal of Physics: Condensed Matter | 6 | 2.7 |
| Nanoscale | 6 | 2.7 |
| Nuclear Instruments and Methods in Physics Research Section B: … | 5 | 2.2 |
| Soft Matter | 5 | 2.2 |
| Applied Physics Letters | 4 | 1.8 |

### 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.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel | Number | % of Total Publications | Lead-author | Lead-author % of Total |
| Nature Nanotechnology | 1 | 0.4 | 1 | 100 |
| Nature Photonics | 1 | 0.4 | 1 | 100 |
| Nature Physics | 1 | 0.4 | 1 | 100 |
| Additive Manufacturing | 1 | 0.4 | 1 | 100 |
| Nano Letters | 1 | 0.4 | 0 | 0 |
| Physical Review Letters | 2 | 0.9 | 1 | 50 |
| Nanoscale | 6 | 2.7 | 2 | 33 |
| Journal of Alloys and Compounds | 6 | 2.7 | 3 | 50 |
| Physical Review B | 19 | 8.5 | 10 | 53 |
| Soft Matter | 4 | 1.8 | 2 | 50 |

### 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.)

|  |
| --- |
| The bibliometrics are not fully correct; a few high-impact papers (invited Research Perspective articles in Nature journals) are missing but are included in 3.3.4. The broad international collaborations are visible in the author lists, and our staff are invited to conferences and collaborations. Our strategy is to publish the results of rigorously conducted investigations in channels that reach the relevant scientific community, which is also reflected in the journals listed above. Papers in more topic-specific journals, outside of the list, reach current and prospective partners in our sub-fields. |

### 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.

|  |
| --- |
| All faculty have broad national and international collaborations. Board members/chairs in SuperADAM, AM@Å, MyFab, MIRAI, SNSS, UU scattering center, Tandem laboratory, Alva Myrdal centre. Evaluation of experiments at international neutron and synchrotron facilities as well as funding (STINT, SSF), also abroad (Finland, Germany, France, EU, Switzerland, Chile). Conference chairs and organization committees, journal editorial boards. Some 10-15 keynote talks. Retiring PAP is a member of Royal Academy of Sciences and Royal Society of Sciences at Uppsala, and initiated AM@Å and H2@U2 with UU colleagues. Members in >3 education program boards at UU. |

## 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.

|  |  |  |
| --- | --- | --- |
| 1 | Type of synergy | New x-ray scattering infrastructure developed by Gunnar Karl Pálsson (GKP) and Vassilios Kapaklis (VK) for studying hydrogen in metallic glasses is made available as a user facility to all members of the program and department with support from GKP. |
|  | Specific  collaboration | Developed by GKP and VK but use of the infrastructure improves in-house structural characterization across the board of disordered materials. |
| 2 | Type of synergy | More effective on-site synthesis of new magnetic nanostructures and metamaterials by fast feedback-loops between synthesis and analysis. |
|  | Specific  collaboration | Joint supervision of PhDs, joint planning of experiments at in house (large) infrastructure (clean room, ion implantation, characterization by microscopy, ions and screening of magnetic properties) |
| 3 | Type of synergy | Self-assembly of meta-materials |
|  | Specific  collaboration | Self-assembly in soft materials is driven by the interaction between constituents. Tuning magnetic interactions allows to Taylor design self-assembly processes. |

## 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 | UU, materials theory  Malmö (other length scales) |
| Type of synergy | Merging of experimental and theoretical viewpoints in joint scientific projects |
| Specific  collaboration | Gunnar Palsson and Ralph Scheicher, Oscar Grånäs (Materials theory, UU); Vassilios Kapaklis and Jan Rusz, Peter Oppeneer (Materials Theory, UU); Petra Jönsson and Martin Fisk (Malmö) |
| 2 | University and Field | Gothenburg (optics) |
| Type of synergy | Merging of different experimental methods as well as theoretical viewpoints in joint scientific projects |
| Specific  collaboration | Vassilios Kapaklis with Gothenburg University (physics); KAW project. |
| 3 | University and Field | Neutrons scattering, Lund University, Linköping University, ESS, ILL, JCNS, Ludwig Maximilian University, Instituto Biofisika (CSIC, UPV/EHU) |
| Type of synergy | Development of neutron scattering instrumentation and methodology |
| Specific  collaboration | Operation of the instrument Super ADAM, design of surface scattering beamline SAGA. Development of reference layers and resonators and application to soft matter systems. |

### 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.

|  |
| --- |
| Merger with ion-physics will enable modification and functionalization of metamaterials in completely new ways (i.e. ion beam modification) at tunable length-scales. Co-supervision of PhDs working on this is ongoing. Future strategies for sustainable funding are being discussed and planned. Merging perspectives from experiment and theory improve understanding and impact of publications. Working with groups outside Uppsala provides access to complementary experimental and theoretical methods. Neutron scattering activities require and promote collaborations in a wide range of scientific areas. Making new instrumentation more accessible within faculty: new cross-disciplinarity (pro); “providing service” risk (con). |

## 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.

|  |
| --- |
| All project participants aim to define roles clearly from the start. Scientific rigor is continuously discussed and implemented; e.g. Vancouver rules are always used for papers. Collaborating with other groups may give rise to special challenges. PhDs take ethics courses, department has workshops for others. |

## 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.

|  |
| --- |
| No formal initiatives. PhDs and postdocs have freedom within reasonable boundaries, adapted to individuals. Support for writing applications for beam time, starting grants etcetera is given. Main challenge is maintaining access to relevant experimental resources on all levels. |

## 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.

|  |
| --- |
| With the ongoing transition of ion physics into the program there will be an additional 2-3 faculty with complementary expertise in areas of common interest, which will be beneficial for the research activities (critical mass sustained). A few additional early-career positions would be good. |

## 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 |
| Swedish Research Council (VR) | 7.9 | Swedish Research Council (VR) | 9.9 |
| Swedish Energy Agency | 1.7 | Swedish Defense Materiel Administration | 2.2 |
| Swedish Defense Materiel Administration | 1.4 | Swedish Energy Agency | 1.9 |
| Swedish Foundation for Strategic Research (SSF) | 0.9 | STINT | 0.2 |
| Swedish Defence Research Agency (FOI) | 0.3 | Swedish Defence Research Agency (FOI) | 0.2 |
| STINT | 0.3 | Uppsala University Foundations Management | 0.1 |
| Carl Trygger Foundation | 0.1 | Carl Trygger Foundation | 0.1 |
| Other non-profit (within the EU) | 0.0 | Swedish Foundation for Strategic Research (SSF) | 0.1 |
| Wallenberg Foundation (KAW) | 0.0 | Other private companies (Swedish) | 0.1 |
|  |  | Company (outside 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 | 0 |
| KAW Project | 0 |
| KAW Scholar | 0 |
| WAF/WAFx | 0 |
| VR Project | 6 |
| VR Starting | 0 |
| Other grants (may include field-specific grants and Co-PIs) | |
| Röntgen-Ångström grant (VR) | 1 |
| ISIS collaboration grant (VR) | 1 |
| Swedish Energy Agency Project | 2 |
| VR infrastructure SuperADAM | 1 |
| SSF Project | 1 |
| SSF Project co-PI | 1 |
| KAW Project co-PI | 1 |
|  |  |
|  |  |
|  |  |
|  |  |

## 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.

|  |
| --- |
| All faculty staff are expected to apply for project grants, mainly from VR. Postdocs and researchers eligible for starting grants are supported by senior colleagues. Senior PIs circulate project plans for feedback, and we distribute our proposals across several VR panels. Collaborations with groups at UU and e.g. LiU and GU are recurring. |

## 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.

|  |
| --- |
| The program has developed a resilient and flexible funding strategy. Projects, as the national infrastructure SuperADAM, are long term and the flexible allocation of program resources allows group members to apply successfully during transition periods. The program was particularly successful in securing funding for instrumentation and method development projects, both leading projects as well as in collaboration, inside as well as outside the University. A good example is the field of neutrons we built on SuperADAM and expanded the activity with satellite projects, focusing on method development as well instrumentation for ESS. We were able to build a strong network and will expand these activities further in the coming years, by building tighter connections to ESS and exploiting funding opportunities for first science and in-kind projects. We have also been successful with acquiring funding from the Swedish Energy Agency for materials development projects. Funding through industrial or governmental partners should be continued. |

## 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.

|  |
| --- |
| We have identified that the visibility in certain areas of relevance for the program may have hindered us from securing more external funding. Programs, like WISE and SwedNess, are at the core activities of the research program but only very limited funding was secured. To underline our achievements and high relevance for such programs we need to improve communication channels and networking to increase our visibility. Currently the program also lacks larger grants supporting early career, such as starting and consolidation grants. Such grants are important for a renewal process and to secure freedom in research. We need to make sure that young researchers develop a competitive research profile to secure such grants. A better integration in large national programs, like WISE and SwedNess, would support early stage career applications and vice versa. KAW and SSF are hitherto not used to the desirable extent. In the future the funding strategy needs to include diversification. With improved visibility the opportunities to form or join consortia, targeting also larger grants, will increase. |

# 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.

|  |
| --- |
| Program now has 2 Associate prof and 4 Professors. The ongoing merger with ion physics was initiated after an evaluation process 2023 (external advisory group appointed by department) due to the upcoming retirement of the PAP, and it will both strengthen the core and identity of the program and give us opportunities to evolve. This is outlined in later parts of this file. The ion physics group is recruiting an Associate prof 2024. In addition to this, recruiting younger faculty at the interface between the merging partners, would be beneficial for maintaining and renewing the program in a longer perspective. |

## 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

|  |
| --- |
| The latest major recruitment was for an associate professor in materials physics with specialization in additive manufacturing of magnetic materials. The need was identified based on teaching duties within the program and recent research developments. The area of AM is growing in importance for the program in collaboration with chemistry and engineering departments, identifying a natural renewal from previous projects, and this was used to create the desired profile. The AM@Å initiative was specifically targeted and the recruitment allows the program to strongly contribute to the scientific leadership with emphasis on magnetic materials. Liberated resources made a faculty recruitment possible. |

### 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.

|  |
| --- |
| Finding presumable top candidates worldwide for positions is crucial, and they are identified based on e.g. research contributions, achievements, teaching skills and leadership potential. A search group, appointed by the department, including staff from the program is now mandatory for faculty recruitments. The group sets criteria based on research area, teaching needs and career stage balance. The ongoing ion physics recruitment follows this department-set procedure. There are no organized broad actions in the program for finding external candidates for prestigious starting grants (KAW, ERC, VR), another important channel for recruitments. |

## 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.

|  |
| --- |
| All support activities are informal. Every supervisor is expected to advise their PhDs, postdocs and junior researchers. Offers of courses, workshops, grant application pitchings etc, from department, faculty or UU, are forwarded to relevant groups of employees as they appear. Teachers’ and supervisors’ courses are encouraged when relevant, as well as mentoring networks. Docent and distinguished teacher qualification plans are discussed in the standard employee dialogues, and/or spontaneously, whatever happens first. Feedback on grant applications is offered on-the-fly. Distinguished teacher qualification is not relevant on this level (we have no adjuncts). |

### 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.

|  |
| --- |
| Materials Physics is a small program. Offers of courses, workshops, grant application pitchings etc, from department, faculty or UU, are forwarded as they appear. Teachers’ and supervisors’ courses are paid by the department. Docent, promotion to Associate, and distinguished teacher qualification plans are discussed in the standard employee dialogues, and/or spontaneously, whatever happens first. The director of studies is used for teacher development dialogues. Feedback on grant applications is offered both on-the-fly and in self-organized small groups. We have had only 1 Assistant prof, who got a department startup package and who was promoted to Associate in 2022. |

### 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.

|  |
| --- |
| Materials Physics is a small program. Offers of courses, workshops, grant application pitchings etc, from department, faculty or UU, are forwarded as they appear. Teachers’ and supervisors’ courses are paid by the department. Docent, promotion to Professor, and distinguished teacher qualification plans are discussed in the standard employee dialogues, and/or spontaneously, whatever happens first. The director of studies is used for teacher development dialogues. Feedback on grant applications is offered both on-the-fly and in self-organized small groups. |

## 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.

|  |
| --- |
| The collegial atmosphere in the program is open and supportive, and we discuss projects and opportunities with staff on all levels. Several of our PhDs have been ombudsmen for the whole department’s PhDs, and the students are overall very engaged. Questions about promotions and career paths, from all staff, are given proper attention when raised. Lately we have gathered the faculty staff more regularly to discuss strategies for grant proposals and research directions. A benefit of a small program size is that we all know each other and there are basically no thresholds, and this should be utilized and preserved. We want this open collegial atmosphere to remain also with the addition of the ion physics group, and will take actions to ensure a smooth transition. For recruitments, we should maintain the current number of postdocs. |

## 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.

|  |
| --- |
| More effort into identifying strong and suitable external candidates for starting grants (WAF, ERC, VR). This is one way to rejuvenate the faculty staff by recruiting on the Assistant/Associate prof level.  Recruit more PhD students, which requires more external grants for funding.  As stated under 4.4, we need to ensure that the collegial supportive atmosphere is maintained also within the larger program after the merging.  Academic staff has good engineering competence, but sometimes devotes to much working time to equipment maintenance and trivial development. Increased access to engineering staff is planned/intended.  The support for staff at SuperADAM needs to be improved further, and that involves also increasing the understanding at the central university administration for the special conditions that apply. Operating an international user facility in another country is a huge challenge. |

# 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 | Collaboration with companies making Fe-based amorphous powder for AM of soft-magnetic parts (ex. Höganäs AB) |
| Value to the program | Learn from industry. Access to starting material for AM production |
| Value to the partner | Fundamental research is needed for better understanding of relationship between composition, printing conditions and physical properties of the printed parts. |
| 2 | Example and connection | Governmental bodies. Improved material performance for high performance applications in so called “platforms” – vehicles in any form for different types of transportation |
| Value to the program | Taking material interface interaction to new understanding and performance |
| Value to the partner | Gaining access to material with improved performance pushing the boundaries for what is possible |
| 3 | Example and connection | We collaborate with Studsvik Nuclear, SKB, and Malvern Panalytical on aspects of hydrogen interaction with materials or their structure. |
| Value to the program | See what industries need now |
| Value to the partner | Knowledge about what happens to their materials |

### 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

|  |
| --- |
| The majority of collaborations started through ongoing research activities and personal contacts. Intellectual property developed within the program has also led to collaborations and outreach (e.g. Exmet). To preserve and expand them, the program has to be seen even more as a key “player” within materials in Sweden and internationally, investing more into networking and communicating directly with industry and society actors (e.g. AIMDay participation). All lab work requires resources (staff and consumables) to maintain high-level collaborations. |

## 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.

|  |
| --- |
| Available resources are currently and mostly of an informal character. The program has a well-established network of contacts. Alumni of the program have been playing a strong role is several of the collaborations and are expected to do so in the future. In recent years more department and faculty resources have been explored and evaluated (i.e. MIRAI, H2@U2). We have also contributed without dedicated support to popular science activities organized by the department (13x13 lecture series), faculty (high-school fairs/visits, SciFest) and nationally (Lise Meitner-dagarna). |

## 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.

|  |
| --- |
| The current network is valuable and productive. It should be fostered further and expanded. The addition of new staff from the merger will have a constructive effect. The latest efforts into networking through higher organizational levels (i.e. Faculty) will soon yield results and the increased visibility after the merger and formation of a more complete and larger unit are aligning constructively with collaboration and outreach aims.  The collaboration examples in table 5.1 are working well and will be continued. |

## 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.

|  |
| --- |
| The participation of staff in networking events, such as AIM Day or similar, needs to be strengthened and organized. Direct contact with potentially new contacts and actors within Materials on the national and international scene, is something the program needs to strive for. A clear plan for staff representation on big national initiatives and organizations (i.e. Jernkontoret, Swedish Energy Agency, H2 Green Steel, etcetera) has also to be devised. This representation should not be confined only to the PAP but should match the most suitable staff for each case. |

# 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 |
| MSc program in Energy Systems Engineering (ES) | BSc+MSc | 6 | yes |
| BSc program in Physics | BSc | 5 | No |
| MSc program in Materials Engineering (Q) | BSc+MSc | 5 | no |
| Courses in measurement techniques | BSc+MSc | 3 | yes |

## 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 |
| X-ray characterization lab, used in project courses on BSc and more specialized courses on MSc level | Condensed matter physics, neutron scattering, nanoscience | BSc, MSc | 20 |
| Super ADAM, used for training PhD students and in some cases MSc project students |  | PhD, (MSc) | 10 |
| Physics course labs (department), used by the students as an important part of learning scientific methodology as well as for visualizing concepts from theoretical sessions | Electromagnetism, Mechanics, Thermodynamics, Optics, Measurement techniques | BSc, MSc | >1000 |
| Teacher demo resources (department), used by lecturers/teachers for demonstration experiments in lecture halls | As above | BSc, MSc, PhD | >1000 |
|  |  |  |  |

## 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 | Lab exercises and research visits exposing the students to the methods of neutron scattering |
| Course Info | Neutron Scattering (MSc; 10 students/y) |
| Value to teaching/ research | Teaching: Wide range of material science topic taught, general understanding of scattering methods  Research: Provides the basic understanding of neutron scattering to allow method development and advanced experiments. |
| 2 | Example | Emphasis on instrumentation and data analysis with coding tools in Matlab and/or Python |
| Course Info | Measurement techniques course portfolio for Q and ES programs (BSc/MSc; 60 students/y) |
| Value to teaching/ research | Teaching: Highly appreciated courses providing the fundamental for experimentalists. The ES course was created by request of the program.  Research: These courses directly relate to core activities of the program (instrumentation). |
| 3 | Example | “Thermodynamics of phase diagrams” part of the Introduction course in the Materials Science Master program |
| Course Info | Introduction course in the Materials Science Master program (recently launched MSc; 15 st/y) |
| Value to teaching/ research | Teaching: Our contribution is vital, as phase diagrams and transitions are crucial for the understanding of materials. We teach having designed a hands-on thermal analysis lab and computational exercises in Python.  Research: This course links directly to the core research activities of the program, and teaches prospective PhD students topics that are crucial for us. |
| 4 | Example | Engagement in Q program board, where Vassilios Kapaklis is a member |
| Course Info | N/A (Q is a BSc/MSc Engineering program, taking in 35-40 new students a year) |
| Value to teaching/ research | Valuable connection between our research and the materials engineering students as well as courses in other departments and the program’s industrial contacts |

### 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

|  |
| --- |
| Beyond the text in the table: The research program makes an effort to contribute to teaching in courses with connections to materials research and experimental techniques/procedures, based on a long track record. The overall aim is to maintain a high experimental skill level in our alumni, whether they find work in academia or industry, and to give relevant up-to-date connections to research when possible. Lab assistants (PhDs) have over the years praised their improvement of research practices, from participating in the teaching of the measurement techniques courses. Laboratories for education require maintenance, refurbishing of equipment, supplies and staff to keep them functioning well. |

## 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.

|  |
| --- |
| We are heavily engaged in managing the ES and Q programs as well as the Materials Science master program. This includes meeting with colleagues and students on all levels, and scrutinizing course reviews. Teacher lunches and other discussion opportunities are organized by the department throughout the semesters. Adaptation of relevant research connections is done by each teacher, and by necessity varies depending on the topic of the course. Courses including more advanced experimental techniques are handled informally by the research program in our labs, and this limits the extent to which the methods can be used in some cases (neutron scattering e.g. requires travel, i.e. dedicated funding, currently limited). |

## 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.

|  |
| --- |
| One Assoc Prof coordinates the ES program since 2023. This is well aligned with our current and coming research activities. The other Assoc Prof is a director of studies in the neutron school. We want long-term engagement with the Q program, having representatives in the Board, as it lies close to our core research activities and teaching interests. One professor is now program director for the Materials Science master, which is now under the faculty and will incorporate courses and teaching from all material-relevant departments. This is a good opportunity for networking and defining the future materials landscape in Uppsala and Sweden, through training of future PhD and researchers. Materials physics has several MSc and BSc thesis projects every year, with Swedish and international students, which is beneficial for all parties. Engagement in fundamental physics courses is an important part of our teaching activities, and connections to research are made wherever it is relevant and feasible. |

## 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.

|  |
| --- |
| We have to work for implementing a flexible and multi-length scale approach in physics research ranging from understanding synthesis to functionality into undergraduate teaching on the master level. Providing students, a muti-purpose toolkit of approaches and methods to perform physics research on materials, without being predefined/limited long-time by the present systems of interest has to be a priority. Taking and maintaining a leading role in the MSc program in materials science is important. Also, a larger engagement in solid state and surface physics courses would in this context be highly relevant, based on the research profile. Access to neutrons needs to be improved if they are to be included in the course packages for more students than what is currently the case. Taking the lead in coordinating research and infrastructure for research on hydrogen as planned in the priorities below, also this needs to be broadly reflected in coordinated education. Here too, the focus has to be providing a flexible toolkit in methods and understanding applicable to a very wide range of systems. |

# 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).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Department: | Department of Physics and Astronomy | | | |
| Program: | Materials Physics | | | |
| Title: | Structure and composition on multiple length-scales for tailored synthesis and physical properties of functional materials | | | |
| Support: | May require department support: | No | 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.

|  |
| --- |
| Strengthen the program profile above, as well as the renewal capabilities, by mutually leveraging the competences of materials physics and ion physics. |

### 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.

|  |
| --- |
| We envision to have a fully coherent research environment, that takes advantage of the methodologies of both current research groups, providing crucial insights into structure, composition, and dynamics in materials from atomistic to macroscopic length scales. We envision to perform advanced materials research that provides physics understanding relevant to the entire life cycle of materials - from synthesis to recycling. Examples include in-situ analysis during synthesis, in-situ gas exposure to materials under operation, and real-time exploration of dynamic processes. The broad set of methods becoming available by the merger, will be used to realize this strategy, which brings about unprecedented clarity of physical processes through a multi-perspective view of materials. This broadening of competences will create an excellent and highly flexible breeding ground for renewal, focusing on scientific questions and targeting e.g. materials for sustainability. The holistic approach thus favored will enable us to overcome limitations presented by instrument-oriented strategies. In-house availability enables fast feedback loops and accelerated progress. |

### 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.

|  |
| --- |
| We are now merging the ion physics group with the materials physics program. We will leverage the positive effects of the merger, in terms of access to and the innovation of new in-situ and in-operando synthesis and characterization capabilities (e.g. LigHt) with extremely wide method-expertise in one environment. A critical step will be reinforcing joint PhD supervision, joint grant applications, and a joint meeting culture. Furthermore, a common, integrated training of PhD students, that is reflecting the new capabilities, and the new vision of the program will be implemented. Taking joint scientific responsibility for existing critical infrastructure such as SuperADAM, AM@Å and newly built local infrastructures for total scattering and magnetism, as well as the Tandem laboratory. Multiple senior faculty members will be driving the scientific development of the LigHt infrastructure. The broad toolkit of approaches, methods and instruments for addressing wider materials physics questions, while not being limited by specific systems of interest, must be anchored into the BSc-MSc education and its visibility must be used for future recruitments. |

### 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.

|  |
| --- |
| Environment has succeeded in developing and utilizing necessary tools for their research with limited funding (no off-the-shelf equipment). Examples: operation of SuperADAM at ILL as a National Facility, metamaterials processing at MyFab Uppsala, active role in the establishment of additive manufacturing initiative (AM@Å), X-ray scattering lab, magneto-optical characterization lab. Ion Physics is scientifically leading the national Tandem laboratory, now strongly profiled towards materials, which pioneered in-situ and in-operando characterization using ion beams (VR/WISE grants) and showcased the broad applicability of their method expertise in many fields (engagement in TA-projects by EU). |

## 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.

|  |
| --- |
| The program is unique in combining expertise within both synthesis and characterization of complex material systems. Another aspect is the scientific leadership of broad local infrastructure to be fully established in the merged program, incorporating neutron, x-ray and light scattering, and ion-beam techniques. |

### 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.

|  |
| --- |
| To realize this vision ion physics is merging into Materials Physics with support from the Dept for optimum interfacing and renewal (aiming for new BUL-positions replacing a Prof.) throughout the process. Initiatives e.g. LigHt infrastructure are expected to receive Faculty and Dept. support for optimal implementation. |

## 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.

|  |
| --- |
| The renewal will enable cutting edge materials physics research, utilizing in-house large-scale synthesis, scattering and ion physics infrastructures. This unique combination allows a holistic fast-feedback approach for the development of designer materials suitable to tackle current technological and societal challenges. |

### 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.

|  |
| --- |
| The activities will catalyze emergent materials research, without being system-limited, at other research units within Uppsala University, as the approach and lab resources will become accessible, enabling collaborations and outreach. Furthermore, students/future researchers, training, teaching and outreach. |

## 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.

|  |
| --- |
| Time for taking advantage of synergies of methods (optimizing approaches) and mapping needs of industry. 1MSEK/y from external grants to employ people at the interfaces of the merger. All expertise in the program is relevant. Time for establishing a new meeting culture and knowledge transfer routines. |

### 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.

|  |
| --- |
| The holistic approach will catalyze stronger collaborations with Materials Theory, Chemistry and Engineering, increasing the impact of the research work (high impact publications) in areas such as designer matter, foster long-term collaborations with companies (e.g. energy sector) and industry PhDs. |

### 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.

|  |
| --- |
| Through the ongoing merger, an inventory of experimental resources is available which is enabling the efforts towards this priority. We are currently executing the merging process, and presently explore new ways of meeting and sharing ideas. |

# 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).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Department: | Physics and Astronomy | | | |
| Program: | Materials Physics (and applied nuclear physics) | | | |
| Title: | Platform for neutron research | | | |
| 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.

|  |
| --- |
| Establish a complete concept of a compact neutron source in Uppsala to strengthen research in materials and applied nuclear physics and support ITER and the usage of the European Spallation Source. |

### 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.

|  |
| --- |
| Neutrons are used to address scientific questions such as the structure and dynamics of light elements and magnetism, and nuclear physics far from the line of stability. Neutrons are used in nuclear technology and needed to study radiation effects on electronics and materials. Neutron science is decisive for development of sustainable societies. We will develop a compact neutron facility (HiCANS), with a low access-threshold in Uppsala, as well as user education and training. HiCANS will provide a platform to perform high-end research at key future international infrastructures such as the European Spallation Source (ESS) and ITER. With recent developments of high-current proton accelerators, neutron targets, moderators and time-of-flight neutron instrumentation, compact, accelerator-driven neutron sources became competitive to smaller reactors and spallation sources. A local HiCANS allows UU to expand its positions, lower the access barriers for less experienced users, provide capabilities for education and promote industrial research. The scientific competence developed during the design phase will benefit other infrastructure initiatives at the dept. |

### 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.

|  |
| --- |
| We analyze the needs and opportunities of HiCANS, recently identified in a collaboration between Uppsala and Lund Universities, and use it as input for writing the conceptual design report (CDR). On the basis of the CDR a detailed technical design report (TDR), including performance and radioprotection calculations, a detailed budget and speciﬁcations of all components will be compiled, including benchmarking against existing facilities. The resources required to complete the two tasks are approx. 10 MSek. The TDR will be written in a collaboration between material physics, applied nuclear physics, the FREIA laboratory, and partners in the ELENA network. In parallel, further competence will be built by collaborations on instrument projects at ESS, ITER, and external partners from academia and industry with and interest of irradiation of electronics and material with neutrons. The project would beneﬁt from departmental support aligned with installation of an instrumentation center, during planning and the later stages of construction and operation. |

### 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.

|  |
| --- |
| At IFA we have broad competence in construction and operation of research infrastructures. Relevant examples are in applied nuclear physics (experience in design and development of neutron sources and beams), the FREIA laboratory (contribution to the construction of the ESS accelerator), the Tandem laboratory (operating several accelerators for ion-beam materials research), and materials physics (rebuilding and operation of Super ADAM as national Swedish infrastructure at ILL (Grenoble, France). The programs are engaged in, e.g., ESS instrument projects (SAGA, Port-GISANS), neutron spectrometry at ITER, and a neutron source for IGISOL (Jyväskylä, Finland). |

## 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.

|  |
| --- |
| Currently, more than 50 researchers, in several departments at UU use neutrons in their research. The research is facilitated by the center for neutron scattering. We currently develop a 14-MeV neutron source (NESSA) which provides both support and serves as stepping stone towards HiCANS. |

### 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.

|  |
| --- |
| Neutron science is a key area at the department. Resources are dedicated to NESSA which will support HiCANS. One professor spends part time to promote HiCANS. We plan to increase the support to the project in order to move towards a conceptual design report (CDR), aligned with other infrastructure initiatives. |

## 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.

|  |
| --- |
| Neutron research provides decisive information for several of the areas deﬁned as global issues by the United Nations. HiCANS will provide capacity and continuity to allow long-term projects and education as well as it lowers the entry barrier, which hinders industrial and applied research. |

### 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.

|  |
| --- |
| HiCANS will provide an ideal platform for collaborations at the Department (FREIA - instrumentation, applied nuclear physics, materials physics) and beyond (Chemistry, Geology, Biomedicine, Humanities). It will allow to incorporate neutron science into education, make meaningful input to ESS and ITER and beneﬁt from it. |

## 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.

|  |
| --- |
| For a local HiCANS a CDR and TDR is required. Required resources are: CDR ca. 2 FTE (2.5 MSek) and TDR 6 FTE (7.5 MSEK). They provide the scientiﬁc case, functional layout, expected performance and budget. In addition, resources are required to develop strategies for sustainable funding of the facility. |

### 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.

|  |
| --- |
| A completed TDR, and a plan for construction and a strategy for funding and operation. Being the leading center for neutron research in the country. Signiﬁcant publications in neutron research, training of students, tight collaborations with ESS and other sources/projects. |

### 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.

|  |
| --- |
| We joined the ELENA network (https://elena-neutron.iﬀ.kfa-juelich.de) and contribute to strategies for neutron science on national and European level. Develop the NESSA neutron facility. A doctoral network (EU-GENESO) is planned. Broad support for a HiCANS as national Swedish infrastructure is established. |

# 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).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Department: | Department of Physics and Astronomy | | | |
| Program: | Materials Physics | | | |
| Title: | A science platform for studying hydrogen in materials | | | |
| 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.

|  |
| --- |
| Strengthen hydrogen research & education by build-up of a new science platform and competence bundling |

### 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.

|  |
| --- |
| We aim to lead a cross-disciplinary hydrogen (H) characterization science platform, with unique abilities to determine the physical, chemical and structural effects of light elements such as H in materials, from atomic to macroscopic length scales both in-situ and in-operando. The initiative, based on the recently initiated LigHt-infrastructure, will introduce unprecedented experimental methods combining advanced spectroscopy/spectrometry and integrated combinations for use on a wide range of inorganic and organic systems. Hitherto largely uncoordinated experimental and theoretical activities within at least 3 departments (chemistry, materials science, physics) will be connected resulting in new scientific models and experimental approaches assessing H and its effects in materials across multiple length scales and in systems with different degrees of complexity. The platform will coordinate and provide educational opportunities raising the general competence of alumni. We aim for maximized accessibility, also for Swedish industry. Experiments will complement studies at large IF such as MaxIV/ESS, enabling optimized beamtime usage. |

### 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.

|  |
| --- |
| We seek hard and soft faculty resources to consolidate hydrogen in materials research and teaching activities, thereby establishing world-leading capability at UU. We now merge the ion-physics group into the Materials Physics program consolidating the scientific lead on H in the LigHt infrastructure. This will enable multiple synergy effects by coordinating strong complementary existing efforts. Secondly, we will use LigHt maximally for measuring H in materials as well as collaborate with users within and outside of the program (university and industry). A lecturer position is needed, requiring additional faculty funding (FFF). The lecturer will be pivotal in implementing and contributing to this vision, as well as in commissioning, testing and for establishing protocols to maximize the platform’s efficiency. We aim to consolidate and amplify existing educational efforts on H in materials @UU increase the competence level of students and alumni, benefitting research and industry. Early-stage accessibility will be driven for all activities, to ensure cross-disciplinary impact. Time-limited support will be critical for the start-up phase of LigHt. |

### 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.

|  |
| --- |
| Materials physics has for decades pioneered researching hydrogen in matter on atomic level and designing relevant instruments. The university-wide H2@U2 initiative was created by the program to better coordinate associated research at UU. Faculty from the two merged units has recently been awarded 32.5 MSEK for the construction of the LigHt infrastructure at UU. The collaboration of ion and materials physics yielded high-impact papers and co-supervision indicating large potential to amplify production with the merger, such as the multi-length scale and -methods approach now integrated. Recently, a faculty grant was awarded to the new constellation. There exists a number of relevant industry contacts in Sweden and beyond. |

## 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.

|  |
| --- |
| The equivalent of one faculty as well as 3 PhD students and 2 Postdoc are currently devoted to H-research. 2 postdoctoral researchers were awarded recently to the present constellation. H2@U2 identified H research within several groups within chemistry, materials science and physics as well as uncoordinated teaching. |

### 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.

|  |
| --- |
| The new Materials Physics program can commit in-kind resources associated with three senior members, (GP, VK, DP) to lead the design of the scattering aspects of the LigHt infrastructure as well as the merging of the existing hydrogen characterization platform. Proposals have been submitted to VR and Wallenberg. |

## 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.

|  |
| --- |
| Hydrogen in materials being a crucial strategic aspect of the energy transition, decarbonization of steel, hydrogen as process gas, and for sustainability of society, this activity will contribute to the hydrogen economy also cross-fertilizing existing and developing battery technologies. |

### 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.

|  |
| --- |
| A dedicated and profiled hydrogen characterization laboratory will increase the increase the impact and effectiveness of this type of research nationwide and internationally since the new methods will be melting pots for collaborations as well as with industry. It will be enabling for larger infrastructures e.g. MAXIV, ESS. |

## 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.

|  |
| --- |
| Faculty funds for a lecturer position to build up and coordinate activities at the science platform enabling multiple high-impact scientific cases only to be realized by the combined tools of the infrastructure platform. Time-limited support to complete the platform for opt. operation (progr’s., dep. facul. share cost 10 MSEK). |

### 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.

|  |
| --- |
| Results publishable in top-tier journals. Increased competitiveness of grant proposals from within all faculty by having the platform accessible on-site. Impact on recruitment on senior level due to local options. Leverage H-rel. access from UU to large-scale facilities. New courses, increasing Swedish competence on H. |

### 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.

|  |
| --- |
| Merging the two groups and consolidating H-related science activities. Technical designs of instrumentation. Identifying science cases within the faculty suitable to be addressed. Make an inventory of hydrogen related teaching activities at the faculty; start developing further. Information campaigns towards industry. |

# 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.

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